SCIENTIFIC AMERICAN

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THE CRAMP SHIP YARDS.

The Wm. Cramp & Sons Ship and Engine Building Company's yards and docks have been selected as the subject of the present article, owing to the great number of government and private contracts that are at the present time in course of execution.

The plant is the largest of its kind in the country, and the ingenuity of its general management and the efficiency of its machinery make it in many respects the model ship yard of America.

It has been brought before the public, especially of late, by its good work in building very large and very fast vessels for our navy and our merchant marine service. And there is reason for national pride in this striking proof that vessels of the first class may be constructed by American ingenuity in designing, by the skill of American workmen, and the use in every instance of American materials.

The history of this great industry may be considered to date from the days when William Penn was the patron of ship building on the Delaware. In the early colonial period it was found that timber suitable for ship building grew in great abundance in the vicinity of Philadelphia. And as a result of Penn's patronage and this important natural advantage, the industry was rapidly developed. These conditions prepared the way and made possible the great industry of the present day. The present firm was established by William Cramp in 1830. From that time to the present day the history of the company records a steady and uninterrupted growth. Times have changed meanwhile and a complete revolution has occurred in the methods of ship building; but throughout, the Cramps have kept abreast with the times.

Since the establishment of the works, the Cramps have built in all some 282 vessels. Of these, 21 have been United States steam men-of-war, 4 were steam cruisers for the Russian navy, 73 were ocean steamers of from 1,000 to 10,700 tons register, 54 were tugboats, besides other craft of a variety of designs. The ship yard at present covers 31 acres of ground. It is so equipped that five vessels of the largest kind may be constructed at the same time, and preparations are being made to increase the capacity to eight. In the past twenty years the company has increased their capital from $500,000 to $5,000,000. There are at present employed at the yard over 5,600 hands, and this does not include an enormous amount of labor employed by contributory industries upon which the ship yard depends for material in various stages of their work. The pay roll amounts to $54,000 per week.

The general arrangement of the ship yard may be readily understood by a glance at the bird's eye view we present in this issue. The docks, it will be seen, are naturally arranged along the river front, and directly in the rear of these are the various buildings and the stationary machinery. The buildings are built in the majority of cases of brick, or of steel frames covered with corrugated iron plates. The work of the yard is of necessity very carefully systematized, and a definite part is assigned to each building or section of the yard. If we take up the buildings and examine their equipments in the order in which they are used in the construction of a great vessel, it will be possible to obtain a clear idea of the entire plant. The work of building a vessel may, therefore, be said to commence in the building containing the administrative offices of the company, and the drafting department, a high building near the center of the engraving.

Standing between this and the docks is an immense structure, 1,164 feet long, with an average of 72 feet in width, and built partly three and partly four stories high. This building is provided with two mould lofts, each 240 feet by 50 feet. The floors are as smooth and clean as those of a dancing hall, and these are used for plotting the curves of the hull and the various cross sections from the drawings. Below these lofts are the regular joining and pattern shops, where the next part of the work is performed. The building also includes the shrive board and bending shop, where the iron and steel bars are shaped to form the ribs and framework of the vessels. The building furthermore includes a rolling shop, fitted with powerful machinery for rolling plates and bars of iron to the desired dimensions. Under this roof is a large machine and erecting shop, where the iron frames of vessels are assembled preliminary to constructing the frame of the hull on the stays. These shops include a number of furnaces and forges for heating the metal.

The framework or ribs of the vessel are next carried to the great docks to be placed in position. There are at present five of these docks, having each a length of 600 feet and a width of 70 feet, and capable of holding the largest vessels. When the frames are

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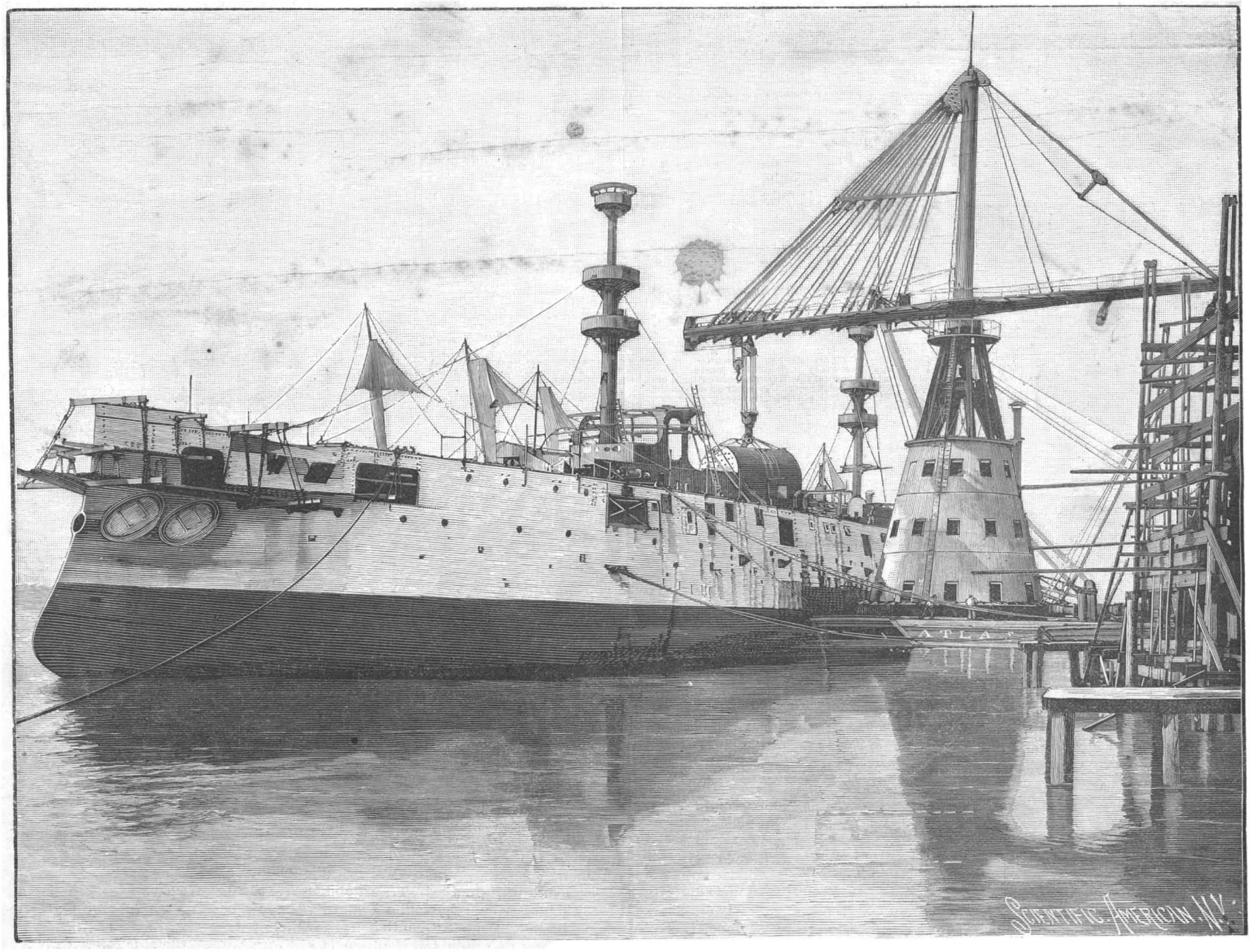

STEAM CRANE ATLAS PLACING A 70-TON BOILER IN THE HOLD OF A UNITED STATES CRUISER.

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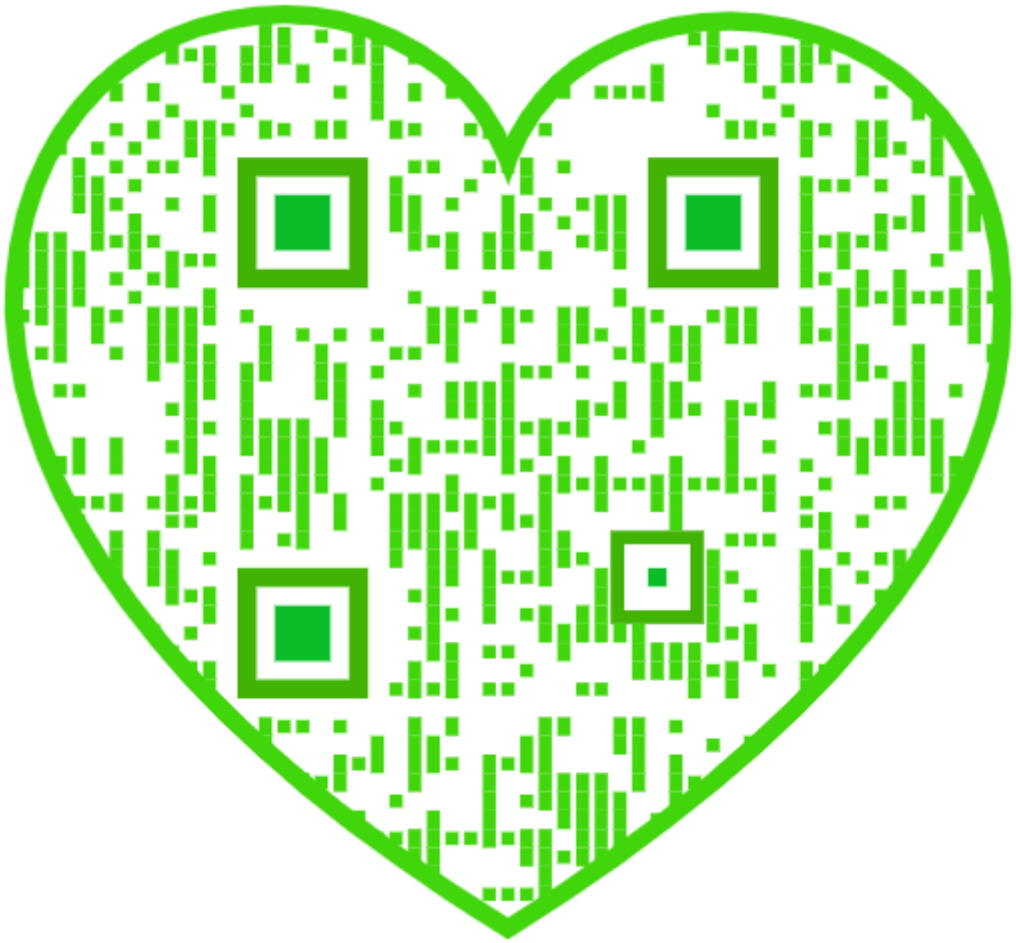

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DECISION AGAINST THE BELL TELEPHONE MONOPOLY.

On December 18 of the present year Judge Carpenter, of the United States Circuit Court, rendered his decision in the suit brought by the Federal government to annul the Berliner microphone patent. The judge on two grounds decides the patent void, and directs it to be delivered up to be canceled. This is a circuit court decision and is open to appeal, and the case, it is to be presumed, will be carried to the higher courts. But the decision is a good one, is very far-reaching, and is the first circuit court defeat which the Bell Company has sustained for many a year.

The suit was brought by the United States through the Attorney-General's office, with Messrs. Causten Browne and Robert S. Taylor as additional counsel. The American Bell Telephone Company was represented by Mr. James J. Storrow and four other counsel. In the title Emil Berliner was joined with the telephone company as a defendant.

The patent in suit is one granted to Emil Berliner on November 17, 1891, and is numbered 463,569. It describes and claims broadly the microphone transmitter of a telephone system. The original date of application was June 4, 1877. For over fourteen years the application was kept alive in the Patent Office by one action after another. Many reasons for delay were assigned, and finally the patent was issued a short time before the two fundamental Bell patents had expired.

For a long series of years the Bell patents had maintained for their owner, the American Bell Telephone Company, an absolute monopoly of the art of transmitting speech electrically, and many millions of dollars of dividends have been earned by this monopoly. The circuit court decisions had been so many and so strong in the patent's favor that any attack on it was hopeless. As the dates approached when the Bell patents were to lapse, a new patent was issued to Berliner, which if sustained would have practically extended the monopoly to 1908. It is a definite fact that the microphone is all that has made telephony a commercial success. The Berliner patent covered in its claims this device most completely.

A quantity of testimony was taken on both sides, and the case was pressed to a final hearing. There were three grounds of action practically, as embodied in the government's case One was the issue of a patent in 1880 to Berliner for the same invention; another was the extraordinary delay in the granting of the patent. On both these grounds the judge decided in the government's favor and against the Bell Company. The other ground was the changes in the text, drawings and claims of the application while it was pending in the office. Of this the court takes no notice in the decision.

The 1880 Berliner patent just alluded to, while apparently intended to be for a microphone used in the role of receiver, something for which it is not well adapted, contained a claim for two microphones in circuit with each other, one as transmitter and the other as receiver. This enabled the court to find in it the transmitter of the patent in suit, and hence to decide the patent in suit to be void, as two patents cannot be awarded for the same invention.

The delay in the issuing of the patent receives by far the most consideration in the decision. This was undoubtedly the main point in the case. The court finds that the microphone covered by the Berliner patent had been in use since 1878 by the Bell Company. From 1877, when the application was filed, to 1882, the application for the patent in suit had been regularly prosecuted, and the court finds no fault with the transactions of these five years. About this time the delays which have vitiated the patent began. The case was withheld from issue to await the declaration of interferences. One of the Bell telephone cases, the Drawbaugh suit, came before the Supreme Court. This was made a ground by the Patent Office for more delay, in order to have the decision of the court to guide its actions. This decision was given in 1888. Still a prospective interference with the same party was awaiting a public use proceeding in the office. Drawbaugh was thrown out on this, so that finally in 1891 the Commissioner decided that the patent should be issued. The threatened Drawbaugh interference had kept the patent from issue for years. Ordinarily a patentee feels aggrieved at delay, but here was a case where delay was of the utmost value, provided the patent could be obtained and upheld. The Patent Office took upon itself judicial and quasi-paternal functions; acted as if a patent were more than prima facie evidence of originality, and in committing a wrong, fortunately established a precedent for greater promptitude in the future.

There is one most excellent assertion in the decision, where the judge speaks of the Commissioner ascertaining "prima facie and with sufficient certainty for the purpose of an administrative decision, by whom the first invention of the microphone had been made." The true functions of the Commissioner of Patents have never been better outlined. A prima facie case for administrative action is all that is needed to justify the issue of a patent and the Commissioner is not to be a self-constituted judge.

We have repeatedly advocated in these columns the propriety and the importance of the liberal treatment of inventors by the Patent Office. The true function of the office should be the granting of patents, not the endeavoring to adjudicate as to the merits of an invention.

Were the system changed so that patents would be granted on application without all the examination for priority, originality, and even utility, that is now given the inventions claimed in the applications, the interests of the public would be conserved. There would be less desire for useless patents than now, when the squeezing of a patent through the Patent Office gives it, in the eyes of its owner at least, a sort of judicial force. The best attorneys would be required in the system, as the search for originality would be done outside of the Patent Office, and inventors would be careful not to waste their money on useless letters patent.

THE HEAVENS IN JANUARY.

There is something besides the planets and the constellations to interest star gazers during the coming month. In truth our good ship, the earth, as she cleaves the ethereal ocean is continually bringing into view some new sight for those who keep a sharp watch to larboard and to starboard. The astronomical outlooks, on November 1, spied a comet coming sunward. With that keen sense of recognition which enables a seaman to name an approaching vessel before its hull has fairly risen, they at once pronounced the stranger to be Encke's comet. It is in the constellation Pegasus, and on January 1 it will be three or four degrees southwest of the star Theta in that constellation, and will set a little before 10 o'clock in the evening. By the middle of the month it will have passed into Aquarius and will be near the star Alpha Aquarii, and at the end of the month it will be close to the northern border of Capricornus, and will set before 6 P. M. It will be in perihelion on February 4. Encke's comet is rarely bright enough to be seen with the naked eye, and the interest it excites is due principally to the evidence it gives of encountering some resistance in space. Its period is a little less than three years and four months, but this period has been gradually shortening ever since the comet's discovery in 1818. Until 1868 it lost about two hours and a half on each circuit, but since then the rate of shortening has been reduced one-half. What causes the shortening of the period, and more particularly what caused the change in 1868, is more or less a mystery. A resistance to the comet's motion would accelerate its return to perihelion by sending it closer to the sun, and thus compelling it to quicken its pace; but the exact nature of the resistance remains to be discovered.

Mars and Jupiter continue to attract universal attention. Mars has just crossed the line from Pisces into Aries and is on the meridian, at the beginning of the month, at 7 P. M. At the end of the month the planet, which is moving eastward, will be near the star Pi Arietis, and will pass the meridian about 6 P. M.

Jupiter is in Gemini, immersed in the Milky Way, near the stars Mu and Eta, and the magnificent cluster M 35. It is a glorious neighborhood. He is moving slowly, one might say majestically, westward, as if to meet Mars and complete the subjugation of the already humbled planet of war. About the end of the month he will cross over into Taurus. On the 1st he passes the meridian about 11 P. M., and at the end of the month about 9 P. M. His wonderful disk has never appeared more splendid in the telescope than it does this winter. Whoever wishes to see a giant world in an early stage of its evolution should look at Jupiter. Here is answer for Keats' banished god crying,

"Where is another chaos? Where?"

As last month, I give again a few dates, in Eastern standard time, on which the interesting phenomena of the transits of Jupiter's moons and their shadows may be witnessed with the aid of a three or four inch telescope.

On January 3, satellite III will enter on Jupiter's disk at 8:55 P. M., its shadow will follow at 10:10 P. M. About 11:30 P. M., the shadow will be near the central meridian of the planet. At about 9:38 P. M., satellite I will reappear from eclipse on the eastern side of Jupiter.

On January 16, satellite II will enter on the disk at 7:37 P. M.; the shadow will follow at 8:50 P. M., and the latter will be near the central meridian about 9:40 P. M.

On January 25, satellite II will reappear from eclipse on the eastern side of Jupiter at 8:58 P. M. At 9:38 P. M. satellite I will enter on the disk. The shadow will follow at 10:26 P. M., and will reach the central meridian about 11:30 P. M.

The satellites cross the disk from east to west. Satellite I and its shadow pass near or upon the great south belt; the others pass farther to the south.

Neptune is in Taurus, near the star Iota. Only a very powerful telescope can show Neptune's satellite, and the most powerful fails to reveal any distinctive

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features on the planet's dusky green disk. It is not visible at all to the naked eye.

Mercury is out of sight on the other side of the sun.

Venus is evening star, but too near the sun to be well seen this month.

Saturn is in Virgo, close to the boundary of Libra and a little east of the star Kappa. It rises at 2 A. M. at the opening of the month and at midnight at the close.

Uranus is in Libra, above the star Iota, rising about 3:30 A. M. at the beginning and about 1:30 A. M. at the end of the month.

January opens with a crescent moon. The moon attains first quarter in Pisces at 2:52 A. M. on the 4th; fulls in Cancer at 1:50 A. M. on the 11th, and reaches last quarter in Virgo at 5:55 P. M. on the 17th. She is in perigee or nearest to the earth at 7:14 P. M on the 11th. It will be observed that the time of the moon's nearest approach to the earth this month differs by only a few hours from the time of full moon. The result must be higher tides than usual about the 11th, and those who believe in the theory that earthquakes are more likely to occur when the tidal strain upon the earth is greatest might expect, about that date, a confirmation of their opinion.

The moon will be in conjunction with Mars on the afternoon of the 5th, with Neptune on the afternoon of the 8th, with Jupiter on the afternoon of the 9th, with Saturn on the afternoon of the 18th, and with Uranus at midday on the 19th.

Among the fixed stars this month, Sirius, the Dog Star, easily takes precedence, as he always does when in the field with his rivals. Observe the incessant activity of his rays, and disentangle, if you can, the diamond flash of prismatic colors shot out of the interior whiteness. The greatest compliment a poet ever paid to an epic hero was that of Homer to Achilles in likening him to Sirius when he chased Hector to the Scean gate:

"Him the old man Priam first beheld as he sped across the plain blazing as the star whose name men call Orion's dog. Even so, on Achilles' breast the bronze gleamed as he ran."

The celebrated companion of Sirius was last seen by Mr. Burnham with the great Lick telescope, in 1890. But if Burnham's calculation of the orbit in which the companion travels is correct, the little star should emerge from the effulgence of its master orb during the present year and become visible again with a few of the largest telescopes.

Among double stars favorably situated for observation during the evenings of January may be mentioned Castor in Gemini. The two stars composing it are of the second and third magnitude respectively, and are nearly 6″ apart, so that a 3 inch telescope separates them beautifully.

Those who have more powerful telescopes—a 5 inch aperture, for instance—may look at the fine triple star Zeta in Cancer. The two nearest components are only 1″ apart, while the distance of the third star is more than 5″.

It is very interesting for us, whose god of day is single and independent, to behold some of those coupled suns. GARRETT P. SERVISS.

Tricolor Lantern Slide Projection.

Nearly a year ago we described and illustrated Mr. R. D. Gray's triple lantern for the projection of triple lantern slides in the colors of nature, and alluded to his success in getting the three images superposed over each other on the screen in exact register and to the marvelous blending of the three colors—red, blue, and yellow—so perfectly as to bring out in comparative harmony all of the varying shades and grades of color, of the different objects of the view. At the annual stereopticon exhibition held in the office of the SCIENTIFIC AMERICAN for the entertainment of its numerous employes and friends, on the 20th instant, Mr. Gray exhibited his improved apparatus and projected fifty or more of his beautiful colored pictures of Irish and Switzerland scenery taken by him on a special trip for the purpose during the past summer. One noticeable characteristic of his mountain scenery, especially in one or two views of the Jungfrau, was the delicate azure blue of the sky, against which, clouded slightly in front by an atmospheric mist, appeared the grand snowy peaks of the mountain; there were other views of Mont Blanc and Chamounix Valley, the Mer de Glace, the glaciers forming the source of the Rhone, the cataract of the Rhone falling from the foot of a glacier; examples of portraiture, showing the color of the hair and skin perfectly; flowers, gladiolas, and a combination of various kinds of fruit, that were wonderfully realistic and delicate in color.

Mr. Gray has special methods of modifying the colors during the time the picture is on the screen, and produces tints which are quite true to nature. His control of the blue in the skies, making them much more natural than one would expect, greatly enhanced the beauty of the landscapes. Mr. Gray is giving a series of exhibitions in this city of his colored views. The next one, we understand, occurs on the evening of December 30, at Hardman Hall. He has worked industriously to develop and perfect the tricolor method of taking and reproducing photographs in colors, and merits the success he has attained.

Army Signaling.

A recent number of the Electrical Engineer contains an interesting article, by George Heli Guy, descriptive of the methods of signaling in the U. S. army, as practiced at Fort Riley, Kansas, from which we make the following abstracts:

The means of communication by day used by the Signal Corps are flags, heliograph, and the field telegraph and telephone trains; and by night, the torch, flash lantern, rockets, bombs, and search light. The method of visual signaling by flags consists in waving a flag to the right for a dot, to the left for a dash, and to the front for the space in the American Morse code. The heliograph, in brief, consists of a combination of mirrors by which a beam of sunlight is thrown in the required direction, and the dots and dashes of the Morse code are made by the opening and closing of a shutter placed in the track of the beam of sunlight. The heliograph has been used recently by the corps up to a distance of 182 miles. At night the Morse code is sent either by the waving of a torch or flashes of light from the flash lantern, the illuminant being coal oil.

The telegraph cable cart can be run either by hand or by a horse. It will carry four miles of double cable. A field kit is attached by a flexible wire to the cart, and communication is always possible, whether the cart is at rest or in motion. The field telephone kit carried by the operator is a leather box, 9½ inches long, 8 inches high, and 4½ inches wide. It weighs about 10 pounds, and contains a Morse key on a buzzer circuit, a Berthon-Ader combined transmitter and receiver, and two cells of dry battery. The Morse key is used as a call for the telephone, and—in case the telephone breaks down—to send messages on the buzzer. The receiver and transmitter are in one piece. The box is carried slung over the shoulder, and does not in any way impede the progress of the operator.

The method of erecting the telegraph line is briefly as follows: At the head of the line the battery wagon is stationed; then a "surveyor" marks the general direction of the line. He is followed by "markers" and "pin men," the markers pacing off the distance of about 55 yards and the pin men placing pins, similar to surveyors' "pins," in the ground to mark the location of the poles. These are followed by "crow bar men," who dig holes for the reception of the lances from 18 to 24 inches deep, according to the character of the ground. A lance is delivered from the lance truck, the wire men put the wire, which has been laid on the ground from the wire wagon, on the insulators, insert the lances in the holes, haul taut on the line, and tie the wire about every fourth or fifth lance with a tie insulator. When the line reaches the desired point, instruments are joined on, and communication made with the battery wagon, which has an instrument on the line at all times. In favorable country the train should average at least two miles an hour.

The balloon train at Fort Riley consists of three wagons for the carriage of tubes of compressed hydrogen and one wagon for the balloon and appliances for handling it. The tubes are of compressed steel, one cubic foot in capacity, and contain hydrogen at a pressure of 200 atmospheres. These tubes are charged at the compressing plant, which is located at Fort Logan, near Denver, Colorado. The gas is generated and the tubes filled there and shipped to the point of ascension. The balloon wagon itself has a compartment for storing the balloon, basket, and netting, and at the rear has a large drum with gearing and brake. The drum carries 2,500 feet of steel cable, which has in its core two insulated conductors for use on the telephone circuit. The wagon is of such weight as to hold the balloon when inflated by its own weight, and after the balloon has once ascended it may be moved over the ground by simply moving the wagon. The balloon itself is of gold beater's skin, of about 13,000 cubic feet capacity, and, when distended, is of spherical shape, with a slight elongation at the neck. The car or basket is of willow wickerwork, light but strong, and sufficiently large to carry two observers, with the necessary amount of ballast and equipment.

The balloon is filled by attaching a linen hose to its neck, inserting the tops of the gas cylinders in the hose, and opening the valves of the cylinders. It takes about 108 cylinders at 120 atmospheres pressure to fill the balloon, and after its inflation the gas is retained for a long period. If there should be an escape of gas overnight, the deficiency is made up from one of the tubes. When the balloon is inflated the maneuvering bar is attached to the end of the cable on the drum of the balloon wagon, and the necessary amount of cable is paid out. The height of the balloon above the ground is, of course regulated by the length of cable paid out, and the observer in the car, having a field kit telephone, can direct the manipulation of the balloon itself as occasion may require.

The equipment of the car consists of an aneroid barometer, prismatic compass, telescope, field glasses, notebook and pencil, telephone, maps of the country, and a camera. The operator is thus fully prepared for photographic work and observation. It may be thought that a balloon would present a good target to the enemy; but the experiments at Shoeburyness with an old captive balloon showed that it is almost impossible to hit such an object with longe range musketry fire, or by artillery fire, especially if it be kept moving, which it always would be. It was also shown by these experiments that the balloon, when filled full of holes by a shrapnel, settled gradually and gently to the earth. When struck it was about 2,000 feet high, and it took 27 minutes to descend to the ground.

Mr. Ives' Triple-Colored Lantern Slides.

Before the Society of Amateur Photographers in this city a few days ago Mr. Frederick E. Ives, of Philadelphia, exhibited his new triple-colored lantern slide on the screen. He makes three bichromated gelatine prints from the three negatives, representing respectively the color values in monochrome of red, blue, and yellow. The positive gelatine print from the red negative is dipped or stained with a light red dye, the others with blue and yellow, then they are superposed in exact register over each other and clamped between cover glasses and bound, forming a tricolor lantern slide. It can then be put in the lantern like any other slide and projected in the colors of nature, provided the respective colors of the stained films are of the proper proportionate value. Specimen slides shown, particularly of landscapes, had the sky too blue, apparently, and were slightly blurred, no doubt, in part, due to a slight refraction of electric light in passing through so many films. He exhibited several flower and fruit pictures, however, that appeared very natural. Commercially it would be expensive to make such slides. He has improved his photochromoscope by making it stereoscopic, thereby necessitating the making of six photographs at one time and providing six duplicate monochrome transparencies. By improved and simplified construction he has succeeded in doing this very perfectly. We have viewed through this apparatus a box of Huyler's candies, fruit and flower pictures, which appeared so accurately that one could imagine they were solid enough to be picked up or plucked.

Brick Dust Mortar.

The use of brick dust mortar as a substitute for hydraulic cement, where the latter cannot be obtained, is now recommended, the Southern Architect says, on the best engineering authority, experiments made with mixtures of brick dust and quicklime showing that blocks of one-half inch in thickness, after immersion in water for four months, bore without crushing, crumbling, or splitting, a pressure of 1,500 pounds per square inch. It is considered, too, that the addition of even as small a proportion as one-tenth as much brick dust as sand to ordinary mortars is preventive of the disintegration so often characterizing mortars used in the masonry of public works. The use of brick dust mixed with lime and sand is said to be generally and successfully practiced in the Spanish dominions, and is stated to be in all respects superior to the best Rosendale hydraulic cement in the construction of culverts, drains, tanks, or cisterns, and even roofs, whether for setting flat tiles or for making the usual tropical flat roof. The proportions used there in the manufacture are, approximately, one of brick dust, one of lime and two of sand, mixed together dry and tempered with water in the usual way.

A Notable Polar Bear.

The large polor bear which for 23 years had lived in the menagerie of the Zoological Society, London, died recently after a fortnight's illness. The bear was presented to the society by Mr. B. L. Smith, who brought it home from an Arctic voyage in 1871. Frank Buckland then described it as "about the size of a Newfoundland dog, but more short and stumpy, with a splendid shaggy coat of long, yellow hair." In its long life at the gardens, under the same careful management by which another specimen of the same species was kept for 36 years in the menagerie, it grew to a size rarely equaled, even by the largest polar bears killed in the Arctic regions, and its weight was estimated at three-quarters of a ton, though during its illness it refused food and became much emaciated.

Mexican Dancing Beans.

The familiar "dancing beans" which have been displayed of late in the shop windows have become a very popular novelty, and great quantities of them have been sold throughout the country at ridiculously high prices. The bean is the seed of the Sebastiana palmeri, a shrub which grows abundantly in Alamas, Sonora, and other parts of Mexico. The curious movement or "dancing" is caused by the antics of a larva, the Carpocapsa saltitans, which is imprisoned in the hollow shell of the bean. The larva resembles closely the common apple worm of our orchards. The bean has no particular intrinsic value.

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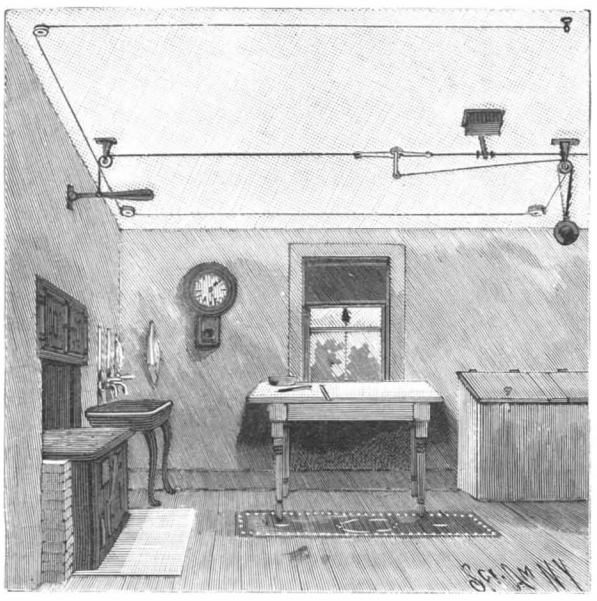
AN INEXPENSIVE FIRE ALARM.

The illustration represents a fire alarm whose operation is not dependent upon electrical circuits, but which operates positively in case of fire to sound the alarm in all parts of the building with which the apparatus is connected. The improvement has been patented by Mr. Eugene P. McCaslin, of Tullahoma, Tenn. (address in care of Alan Parker, First National Bank). A combustible cord, preferably of silk, is run around the ceiling from a peg, passing over guide pulleys, a weight at the end of the cord holding it taut.

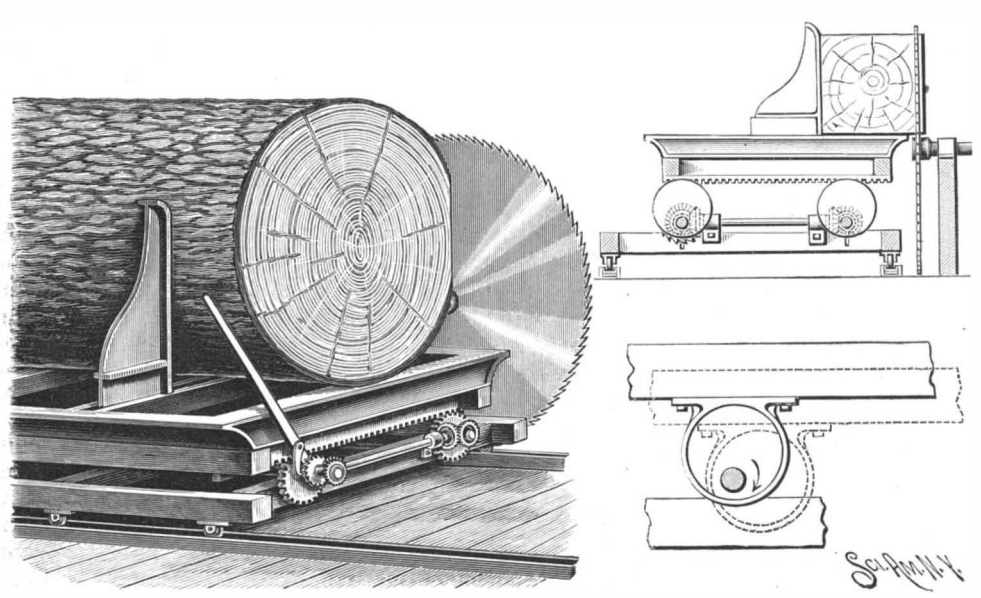


McCASLIN'S FIRE ALARM.

To the weight is also attached a noncombustible cord, whose other end is secured to a tripping lever, a pull upon which disconnects two sections of a taut wire, one section of which is connected to extend through openings into all the adjacent rooms and to all parts of the building, having connection with an alarm at all desired points. If the silk combustible cord is burned, the weight is dropped and the tripping lever operated to cause the separation of the taut wire sections, thus sounding the several alarms. The other section of the taut wire is connected at its other end to a swinging weight fulcrumed on the wall of the room. Any suitable spring alarm may be used with this improvement.

AN IMPROVED SAWMILL CARRIAGE.

To facilitate the squaring of large logs by the use of only one saw of moderate size, instead of employing in the work an upper and a lower saw, the improved carriage shown in the illustration has been devised and patented by Mr. Mat Cox, of Hale's Point, Tenn. Combined with the main frame of the carriage is a supplemental frame carrying the log, the main frame having rollers running in guides on the floor or the ground, the tracks extending in a direction corresponding to that in which the saw moves. Mounted on this frame is a supplemental log-carrying frame, provided with the usual knees or head blocks and mechanism for working them, and the lower or bottom side of each end of the upper frame has a rack bar engaging teeth on eccentrics mounted on logitudinal shafts. These shafts carry miter wheels engaging similar wheels on a transverse shaft imparting motion from one eccentric to the other, upon the operation of a hand lever carrying pawls engaged by a ratchet wheel. By means of this lever, the supplemental frame carrying the log may be raised and carried forward toward the saw, or withdrawn to the lowered position shown in the larger view, one of the smaller figures being a sectional view representing the carriage in its highest position with a squared log thereon. For its first position, therefore, the carriage may be lowered to bring the edge of the log where the saw enters to a point almost level with the axis of the saw, the supplemental frame being afterward raised to the position shown in the smaller view, to do work as has been ordinarily done heretofore. The other small figure shows a modified form of eccentric, doing away with the rack bar and toothed eccentrics, this construction being somewhat cheaper. A short outside shaft attached to the lower carriage, and carrying bevel gears engaging a larger bevel on the longitudinal shaft, affords increased power in raising the carriage and log, and a brake wheel on this shaft, encircled by a band of spring steel, facilitates gently lowering the upper carriage, or arresting it at any desired point. Rests may be provided for the outer edge of the upper carriage, when in its raised and forward position, and a graduated dial over which moves a pointer may be attached to the cross shaft to indicate the amount of forward movement of the upper carriage in being raised, thus regulating the thickness of the plank taken off.



COX'S SAWMILL CARRIAGE.

Great Wall of China.

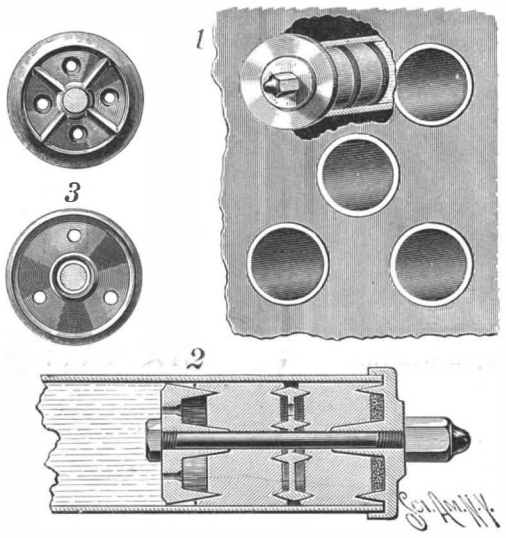
Long ago Mongolia was not a part of the Chinese empire, as it is to-day, and the Hiungnu ancestors of the Mongolians were China's most terrible enemy. So this great wall was stretched along the border between China and Mongolia in order to keep out the formidable invaders from the north. It is probably the only instance in history where the precise boundary between two countries was for ages marked by a stone wall. The wall, or its ruins, may still be traced from the Gulf of Liaotung, at the northern extremity of the Yellow Sea, far over the plains and mountains, nearly to the western limit of China proper.

It was a colossal work and ranks with the Grand Canal of China and the Pyramids of Egypt as among the most stupendous of human achievements. It had a length of over 2,000 miles, counting various sinuosities and the double and triple walls built in a few places, notably to the north of the provinces of Pechili and Shansi. When we consider that this wall had an average height of about 30 feet and a mean width of about 22 feet, and that it is supposed to have contained about 160,000,000 cubic meters of solid masonry, we may gain some slight idea of the enormous labor involved in its construction. But it did not take a very great many years to build it. The Emperor Chi Hoangti was very sure he needed that wall when he began the great work twenty-one centuries ago. It cost as much in human life and treasure as a great war, and cost all the more because so much haste was made to erect it. Several hundred thousand men are believed to have perished while they were at work on the wall, which was to be at once a protection against their country's enemies and a memorial of their martyrdom.

A great many writers have spoken of this wall as a pure waste of human energy. This is a mistake. It is certain that the wall was worth, to ancient China, far more than it ever cost her. From a military point of view it proved to be of prime importance. There is no doubt that for some centuries the hordes of Mongolia were stopped in their war expeditions at the foot of this wall, which marked the southern edge of their land; for the wall was nothing more or less than an immense fortification, the greatest the world ever saw, and there were plenty of Chinese soldiers to man it. Scattered all along the top of the wall were sentinels within communicating distance of one another, and no enemy could approach without these sentinels signaling the fact all along the frontier. Every gate in the wall had its garrison and every mountain pass through which the wall was built had its military camp. Towns were built and agriculture developed along the wall in order to supply the needs of the soldiers, and this fact in itself was a protection to China, as it increased the density of population along the frontier. For fourteen centuries the wall helped to protect the empire from its northern foes. Then came the great conqueror of Asia, Genghis Khan, who forced the mighty rampart China had reared, and from that day the wall ceased forever to be of any strategic value. For long stretches the wall has now almost entirely disappeared. Millions of tons of material have been torn from it to serve the purposes of the near-by inhabitants. The mere wear and tear of the ages alone would have toppled much of it in ruins. The time was when it was a crime punishable with death to so much as scratch it with a pin. Yet it is doubtful if to-day much of the original wall is left. What is now seen of it is the patchwork of the centuries during the time when the wall was China's great bulwark to the north.—N. Y. Sun.

A PLUG FOR LEAKY TUBES IN BOILERS.

A plug of wood or similar expansible material, formed for engagement by metallic rims or heads, to press the plug rims into firm contact with the interior surface of a boiler tube, is represented in the illustration, and forms the subject of a patent issued to Mr. Andrew L. Harrison, of the United States revenue steamer Colfax, Wilmington, N. C. Fig. 1 illustrates the application of the improvement, Fig. 2 being a sectional view of the plug tightened in place in a tube, while Fig. 3 shows face views of the inner head. The plugs are of slightly less diameter than the tube, and are fitted centrally on a bolt having at its inner end a head and at the outer end a tightening head and nut, there being also another head between the plugs. Each of the plugs has an annular rim engaged by wedge-shaped rims on the heads, and the inner head also has a wedge-shaped hub engaging recesses in the bore of the inner plug, while the intermediate head has an annular wedge-shaped projection on both sides to engage corresponding recesses in both of the plugs. In the web of the inner and the intermediate hub are apertures to permit the water in the tube to pass to the wooden plugs, expanding the latter as the moisture passes into the pores of the wood. The outer head used in tightening and forcing the plugs toward each other is somewhat different from the permanent outer head shown in Fig. 2, the tightening head having considerable bearing surface abutting against the outer face of the outer plug, but after the plugs have been drawn partly tight in the tube the tightening head is removed and the permanent one substituted, with its inwardly extending flange and rim and wedge-shaped hub. Before the placing of the latter head cement is placed between the outer flange and rim of the head, the cement, on screwing up the nut, being pressed on to the edge of the tube and on the tube sheet, thus forming a cement joint.



HARRISON'S TUBE PLUG.

Popular Ideas of Inventors.

In a recent address Mr. Alexander Siemens said that it is a popular superstition that the inventors are heaven made, and that they can produce useful novelties to order in any branch of manufacture where a want exists, if only their attention is drawn to it. "The history of the invention of the steam engine," he added, "is a well known illustration of the point I wish to emphasize. According to the popular version, Watt, a small boy, saw the lid of a teakettle move up and down, when the water was boiling, and this suggested to him the construction of a steam engine. As a matter of fact, Watt made himself acquainted with what had been done before (a point altogether ignored in the popular version), and had to work very hard before be brought his invention to a successful issue. His example is typical of the true method of progress, and we may generally say that in order to approach a problem with the most certain prospect of success it is necessary:

"1. To define, as accurately as possible, the want that exists, or the particular object that is to be attained.

"2. To be well acquainted with the scientific principles which come into play.

"3. To know how the want is met, or the object attained in practical life.

"4. To find out what proposals have been made by others in the same or in a similar case.

"A careful attention to these requirements will prevent much disappointment and waste of energy, as will be obvious to all of you without further explanation."

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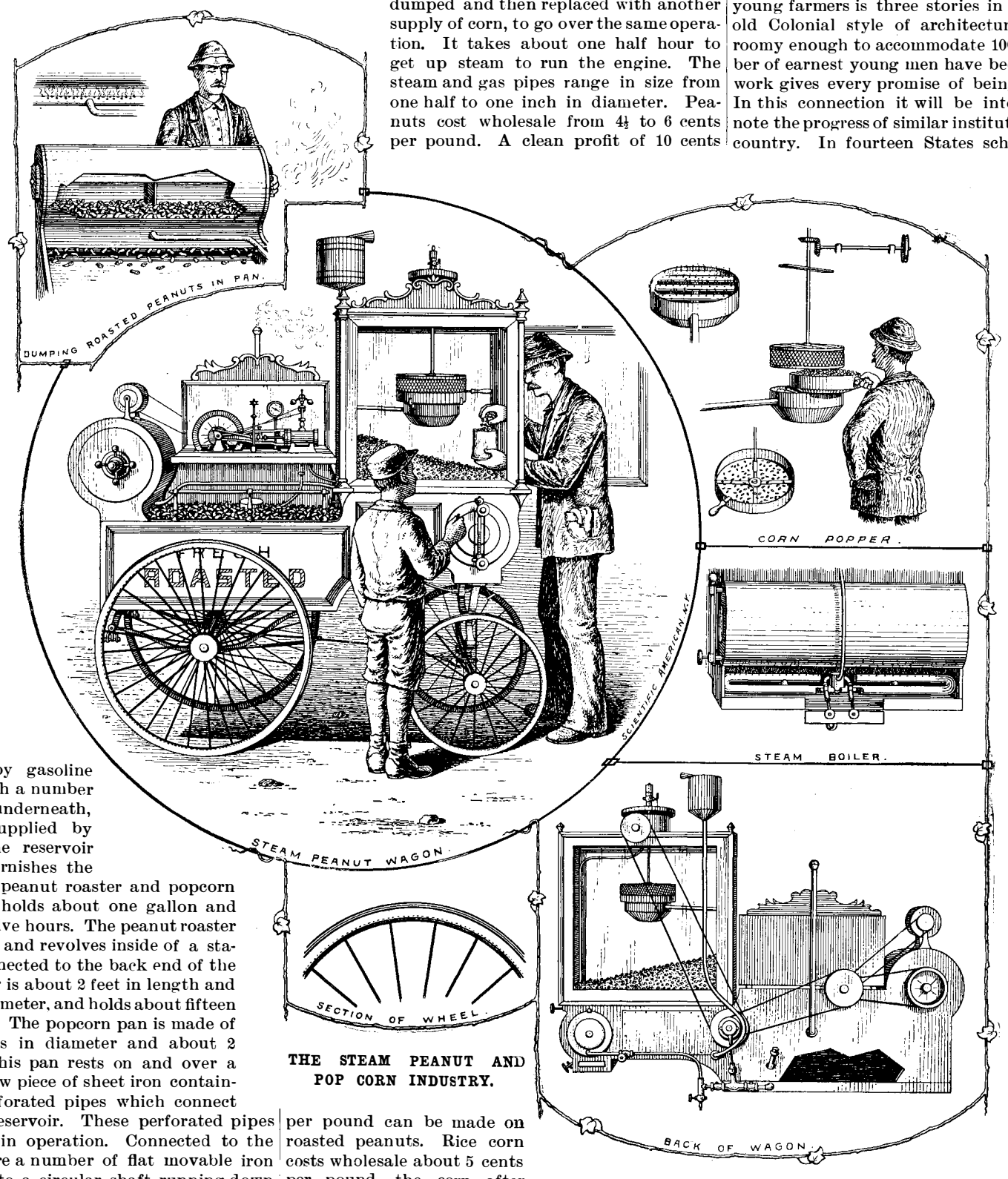
THE STEAM PEANUT AND POP CORN INDUSTRY.

The illustrations accompanying this subject were taken from the apparatus owned by H. Hummels, of Jersey City, N. J. This machine, of which Charles Cretor, of Chicago, is inventor, was designed with the idea of moving it about to any location where the operator would be likely to do a good business. The apparatus, which is light and strong, and weighing but 400 or 500 pounds, can be drawn readily by a boy or by a small pony to any picnic ground, fair, political rally, etc., and to many other places where a good business could be done for a day or two. The wagon is about 5 feet in length and about 2 feet in width and made entirely of metal, with the exception of the popcorn case, which is made of hard wood and glass. The running gear is made light and strong. It has three springs on the rear end and a strong V spring in front. The hind and front wheels, which are made the same as bicycle wheels, with nickel plated spokes and rubber tires, are 30 and 20 inches in diameter. The peanut roaster and corn popper, which are attached to the ends of the wagon, are both run by steam power, the appliances for making the steam being all connected to the wagon bed. The water tank from which the boiler is supplied is made of sheet iron, about 2 feet square and about 5 inches in depth, and holds about four gallons. The water is drawn or forced into the boiler from the tank by means of a small steam pump connected to the machinery at the back of the wagon. The boiler is made of copper and is 2 feet in length and about 9 inches in diameter and holds about two gallons of water. The boiler is heated by gasoline which passes through a number of perforated pipes underneath, the pipes being supplied by means of a gasoline reservoir above, which also furnishes the gas for heating the peanut roaster and popcorn pan. This reservoir holds about one gallon and will burn about twelve hours. The peanut roaster is made of sheet iron and revolves inside of a stationary cylinder connected to the back end of the wagon. The roaster is about 2 feet in length and about 14 inches in diameter, and holds about fifteen pounds of peanuts. The popcorn pan is made of sheet iron, 12 inches in diameter and about 2 inches in height. This pan rests on and over a conical shaped hollow piece of sheet iron containing a number of perforated pipes which connect with the gasoline reservoir. These perforated pipes heat the pan when in operation. Connected to the bottom of the pan are a number of flat movable iron rods, which connect to a circular shaft running down from the top of the popcorn case. This shaft is geared to another running horizontally across the top, connecting itself to the engine by means of a belt at the back of the wagon. The roaster shaft is also connected to the engine in the same manner. The engine, which is situated midway between the roaster and the corn popper, is about 22 inches in length and nickel plated, and runs with from ten to fifteen pounds of steam and makes a 4 inch stroke. The cylinder is about 4 inches in length and about 2 inches in diameter. The fly wheel is about 8 inches in diameter. Geared to this fly wheel is a horizontal shaft which passes out at the back of the wagon. Around the pulley at the end of the shaft the belts are placed, which, when the engine is in motion, causes the roaster and corn popper to revolve. The roaster revolves at a slow rate of speed, making about one revolution every twelve seconds. The peanuts, when roasted, which takes about from twenty to thirty minutes, are then tested by running a long scoop-shaped instrument in a hole in the center of the roaster from the outside, the tester, when withdrawn, having a number of the roasted nuts in it. If the nuts are sufficiently roasted, a slide is removed from the cylinder and it is turned bottom up by the operator, and the nuts fall out and slide down into the 2 foot pan, which holds about fifty pounds, on the top of the water tank. This tank is heated by the waste steam which keeps the peanuts hot in the pan above. Two or three gallons of water will furnish enough steam to run the engine for one day. About one pint of rice corn is placed in the popper at a time. The shaft which connects with the flat rods in the bottom of the pan when in motion causes the rods to revolve, which stirs up and keeps the rice corn moving to prevent its burning. These rods revolve at the rate of about 250 revolutions per minute. The corn when popping is prevented from flying out of the pan by means of a circular piece of network about 2 inches in height resting over it, and of the same diameter as the pan. When the popping is completed, which takes about five minutes, the gas is turned off, the network raised up and the pan taken out and dumped and then replaced with another supply of corn, to go over the same operation. It takes about one half hour to get up steam to run the engine. The steam and gas pipes range in size from one half to one inch in diameter. Peanuts cost wholesale from 4½ to 6 cents per pound. A clean profit of 10 cents per pound can be made on roasted peanuts. Rice corn costs wholesale about 5 cents per pound, the corn after being popped bringing a profit of from 10 to 15 cents per pound. To sweeten pop corn about two and one half pounds of sugar dissolved into a sirup is rapidly stirred into about ten pounds of popped corn. The wagon costs $400.



THE STEAM PEANUT AND POP CORN INDUSTRY.

The Palisades of the Hudson River.

Along the entire length of the Hudson River there is scarcely to be found any more beautiful natural feature than the Palisades. Beginning nearly opposite to New York, they extend along the west bank of the river for a distance of 15 miles, rising perpendicularly from the very edge of the water to a height varying from 300 to 500 feet. The face of the trap rock, of which they are formed, is broken and jagged, and this makes it possible for abundant vegetation to spring up, which adds much to its ragged and massive beauty. It is to be observed, therefore, with very serious regret that the work of blasting and quarrying along the Palisades has already done irreparable injury. And, judging by the appearance of the rock in the vicinity of Fort Lee, which is opposite to the city, the work of giant powder and dynamite promises, unless strong measures be adopted, eventually to destroy this famous feature of Hudson River scenery. The Palisades should be guarded with every possible care, and the preservation of the beauty they lend to the Hudson should be a matter of national pride. Their face is covered with glacial grooves and scratches, which are the hieroglyphics of the written geological history of the past.

Unless this beautiful region be set aside for a public park, or some similar provision be made, it is impossible to tell where the work of destruction will end.

The Growth of Agricultural Schools in the United States.

A very gratifying announcement is that of the opening recently of a well equipped agricultural school at Kensico, in Westchester County, N. Y. The school has been established and will be maintained by a private bequest, and is to be known as the "Brace Memorial Training Farm." The building which is to shelter the young farmers is three stories in height, built in the old Colonial style of architecture, and is large and roomy enough to accommodate 100 students. A number of earnest young men have been enrolled, and the work gives every promise of being highly successful. In this connection it will be interesting, perhaps, to note the progress of similar institutions throughout the country. In fourteen States schools devoted to this special work are maintained for both white and colored students. The total number of institutions offering courses in agriculture is 65. In these institutions the college course leading to a degree in agriculture extends over a period of three or four years, while there are shorter courses in dairying and similar work, which cover only a few months. Besides these there are courses of lectures on farming given in various localities by members of the faculties of these colleges. These courses are particularly popular. Some idea of the extent of this work may be gained from the following figures taken from the United States Agricultural Report: The total number of professors in the faculties of these several colleges numbered in the past year 1,282; the total number of students, 17,623; the total revenue of these institutions for the year was $4,024,132; and the value of additions to their equipment is placed at $1,481,637.

A New Use of Compressed Air.

A novel use of compressed air has recently been made by some Western railroads. Jets of air discharged from flexible hose are made to do the work of brooms, whisks and cloths in removing dust and cinders in passenger cars. The hose may readily be carried to any part of a car and is used in the same manner as an ordinary hose carrying water. The new application has many advantages. In many cases passenger cars on reaching the terminals are only allowed to stand a few minutes before being again filled with passengers, and it is impossible in this time to clean or even dust them thoroughly. This work is usually done by women, who hastily brush off the upholstered parts and wipe the woodwork. A stream of air will effectively remove all dust and dry dirt from cloth and even from glass and wood, and it has the additional advantage of reaching cracks and crevices which otherwise would not be touched. The stream of air is especially effective, it is said, in clearing the cars of flies.

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THE RUSSIAN THISTLE—A SCOURGE TO AGRICULTURE.

BY E. HOFER.

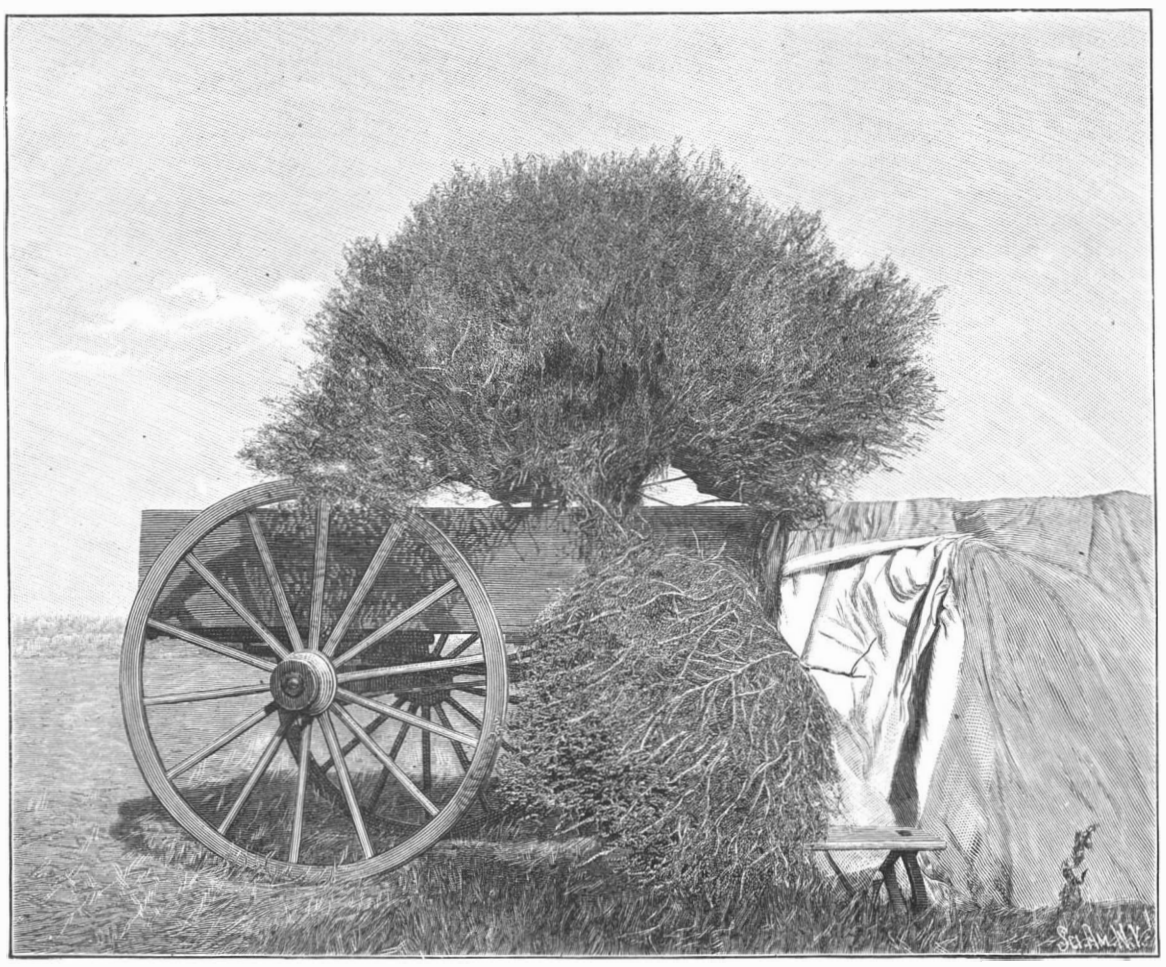
In 1891 the Russian thistle was first reported to the Department of Agriculture. Described as a species of cactus, scientific investigation showed that it was neither a thistle nor a cactus, but a variety of common saltwort (Salsola kali tragus), with the habits of the tumbleweed of the American plains.

This weed, which has become the worst scourge that has ever afflicted agriculture in the prairie States, was introduced into the United States in flaxseed brought from Russia and sown in Bonhomme County, South Dakota. In 1892 it had caused damage amounting to several millions of dollars.

Reports to the department in November, 1893, showed all the counties of South Dakota, east of the Missouri River, and twenty counties in North Dakota infested by the thistle. Its presence was also reported from four places west of the Missouri, two counties in Minnesota, three in Iowa and four in Nebraska. The seed was scattered from Denver to Madison, Wis., and from the Red River of the North into Kansas on the south. The dry season of 1894 leaves a territory of 200,000 square miles thoroughly infested by this scourge and an area of 100,000 has felt its presence as a destructive blight upon all grain crops.

Owing to the drought over this grain-growing region, no correct estimate of actual damage by Russian thistle can be formed. In the Dakotas thousands of fields of grain and flax that would have yielded a partial crop were abandoned. No harvester or thrasher has been found to handle a crop infested by this pest. It clogs the machinery, fouls the grain, and renders fall plowing impossible. The land must first be cleared of thistles before it can be plowed. If thistles are plowed under, even when partially matured, they will spring up more thickly than ever through six inches of soil.

The treeless, wind-swept prairie States are the home of the thistle. It is distributed by the wind, which rolls the full grown ball-shaped plants, from one to six feet in diameter and each holding from 20,000 to 200,000 seeds. We give a photographic illustration showing two of these balls. Like the tumbleweed, it bounds over the prairies with a movement resembling that of the jack rabbit, traveling hundreds of miles, leaping over or breaking down fences, carrying fire before the wind, or endangering property by accumulating in heaps of inflammable material. Horses or cattle cannot be driven across a field rankly grown up to thistles. No animal will eat it after its myriad of sharp spikes appear.



THE RUSSIAN THISTLE—A SCOURGE TO AGRICULTURE.

Grain elevators closed, railroads without traffic, farmers without crops, settlers leaving large areas of otherwise rich farming lands, vast regions without a furrow turned where in other seasons all the grain lands were plowed for next year's crop—these are the signs on every hand of the devastation wrought by the Russian thistle in the Dakotas. At present it is impossible to predict the future ravages of a scourge that has caused damage this year running into the scores of millions and that may drive the grain farmer out of all the prairie States.

The first effects of the thistle will be to drive farmers in the infested region to tilling more cultivated crops. The grain acreage in this region will be reduced from fifty to seventy-five per cent. The granger railroads will show enormous falling off in grain freight receipts for the last quarter of 1894, as about three elevators out of four are closed for want of crops. An immense emigration is taking place out of the regions mentioned.

As the result of an official investigation of the condition of the French navy, it has been found that, out of forty torpedo boats in the service, only twenty-five were fit for service. Most of these boats were rendered unsafe by the corrosion of their hull plates and many defects were discovered in their general arrangement. This state of affairs is very unsatisfactory to the French government.

A Year's Naval Progress.

According to the annual report of the Secretary of the Navy, the interest in naval affairs has been greatly quickened by the war between China and Japan. The recent Brazilian and Bluefields incidents have shown that the respect due to the United States as a nation is largely dependent upon the presence of American war ships in foreign ports. The estimates for the current fiscal year were $27,885,914 and the actual appropriations amounted to $25,366,826. The estimates for the year beginning July 1, 1895, are $30,952,020.

The two types of vessels most urgently needed are battle ships and torpedo boats. The secretary recommends the construction of three battle ships of 10,000 tons displacement, the cost not to exceed $4,000,000 each, and twelve torpedo boats varying from 100 to 300 tons displacement, the average cost to be $170,000. The value of the battle ship in the warfare of the future is generally conceded, and Captain Mahan has pithily expressed the whole matter when he said that battle ships were to a navy "what infantry is to an army." In conflicts on land the infantry, which must always form the backbone of an army, is supported by cavalry and artillery; so the fast cruisers and the legion of smaller fry—the gunboats, the torpedo catchers, torpedo and dispatch boats—should rally round and support the battle ship, which must be regarded as the main source of reliance. We have all, perhaps, in the past pinned our faith too much to the cruiser. We must not forget that the crippling of the merchant marine of an enemy is not in itself sufficient to decide a war. The Alabama and other cruisers of the Confederacy effected an enormous pecuniary loss, but did not influence the result of the war. From 1792 to 1812 the French cruisers and privateers preyed on British commerce, but it flourished notwithstanding. Captain Mahan says:

"Military superiority depends upon heavy blows struck at the enemy's organized fighting force. Such blows must be struck by massed forces, the units of which should be individually powerful for offense and defense, because so only can they be brought under the unity of command essential to success. The same aggregate of force in two or three different vessels will rarely be equal to that concentrated in one, because of the difficulty of insuring mutual support. This means heavy vessels or battle ships."

They may also be viewed from the standpoint of economy, for they will remain for a far longer time without being outclassed than a cruiser. The limit in the size of guns appears to have been reached, and it is doubtful if any material change will be made in calibers.

The need for additional torpedo boats is even more apparent. There is something splendid in the idea that an enormous battle ship, bristling with the finest cannon and provided with the thickest armor, can be conquered by a little vessel of 150 tons burden. It is the old story of David and Goliath. Notwithstanding all of the defenses against torpedoes, such as nets and rapid-fire guns, a properly fired torpedo from a vessel costing $100,000 will destroy a great battle ship worth $4,000,000. The sinking of the Aquidaban furnished a lesson in the value of the torpedo in modern warfare. With the three torpedo boats about to be built, our navy will have six in all. France possesses 214 torpedo boats and 41 building; England has 175 and 64 building; and Russia 163 with 14 building. Such figures show how far behind other nations our navy really is. It is chiefly the fault of Congress in making such inadequate appropriations.

During the present year the Naval Observatory has been placed under the charge of Prof. Harkness, a civilian.

The Submarine Detector.

This instrument and its use are thus described in the London Electrical Review:

The apparatus is based on the principle of Prof. Hughes' induction balance, and it consists simply of an electrical arrangement contained in a small mahogany box, which is carried on board the searching vessel, and a sinker, which is trailed along the bottom. The sinker also contains an electrical arrangement and is connected with that in the box by a light electrical cable of any required length. The apparatus includes a small battery and an automatic contact breaker, which opens and closes the battery circuit at short intervals. The battery circuit includes two primary coils, one in the box and the other in the sinker. Each primary coil has its secondary coil, and both the primaries and secondaries are respectively connected up by conductors, which are inclosed in the suspending cable. In the searching vessel there is a telephone, which is included in the secondary circuit. The apparatus is adjusted so that under ordinary circumstances there is silence in the telephone. When, however, the sinker approaches a mass of metal the balance is upset, and sounds become audible in the telephone, while these are reduced in intensity as the sinker recedes from the metallic object. Three hundred feet of electrical cable were employed with the detector in searching for the Rusalka, and the depths searched varied from 15 to 50 fathoms. The search was continued for several weeks, and the exact position of the foundered vessel was at length placed beyond all question, as every time the searching steamer passed over a given spot the electric indicator of the detector sounded loudly, thus affording evidence that a large mass of metal was submerged below. After the vessel had been located the divers descended and examined her, the result of their examination being, so far as is at present known, that she had foundered through serious damage to her stern.

Fire From Steam Pipes.

The Southern Lumberman in a recent issue gives the following solution of fire from steam pipes: Neither ordinary live steam nor "superheated" steam will heat a pipe thick and strong enough to convey it to a degree sufficient to produce a fire on wood, however dry. It will not even set charcoal aglow or in a blaze. But dry charcoal, when the heat is removed from it, being nearly pure carbon, will absorb oxygen from the air under favorable conditions, so rapidly as to produce active combustion—that is, a glow or a blaze. The process of the origin of a fire from a steam pipe is: The heat from a steam pipe will, in the course of time, char, or, as the chemists say, carbonize, wood in contact or close to it. When this charring process extends to any depth in the wood it presents a surface full of fissures and cracks, thus exposing a large section to the action of the air. This process of charring drives the oxygen out of the charred portion and keeps it out while the heat is kept up. When the heat is removed the charcoal reabsorbs oxygen from the air, and if this action is rapid enough in a dry atmosphere, combustion is the result. This explains why fires in steam plants and buildings heated by steam, that originate from steam pipes, always occur after the pipes have cooled—generally during the night. The idea of "superheated" steam in a cold pipe is the most absurd one we ever "ran up against."

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Correspondence.

Invent Something.

To the Editor of the SCIENTIFIC AMERICAN:

There is an article in December 1 number of your paper entitled "Invent Something." So far, so good. But I wish to state that I have invented some things; but, like many others, had not the means to get a patent and put them on the market. A man gets a patent, then shows his invention. The answer is, Yes, it's a good thing. After awhile an improvement is made by some one, and No. 1 is knocked out. Now, if some man, or men, of the Peter Cooper type, would take the patents of all who would desire, and, if the patent proved a success, why pay the inventor a percentage, they could back up the patent in such way that no one would infringe upon it. Many a valuable patent has been lost to the world by the inventor not having the opportunity to get it out. I have tried to present this matter, but in a feeble manner, and trust that you, with a great journal and great opportunity, will give it more than a passing thought. New York has millions of dollars that could be put to no better use than to bring out the inventive genius of our people.

Passaic, N. J. JAS. H. ROSCOE.

Bleaching With Sodium Silicate.

A new departure has recently been made in France in the application of soluble glass to the bleaching of linen. At a recent meeting of the Paris Academy of Science, Mons. G. Geisenheimer described some researches which in brief are as follows: In order to insure the complete bleaching of linen, it is customary to increase the causticity of the lye, and to prolong the time of boiling, with the result that the fabric is injured though its color is improved. The production of yellowish or brownish patches on the linen is usually attributed to impurities in the chemical used, but is chiefly due to the presence in the water of calcium and magnesium salts, which are precipitated on the fabric, and act as mordants, fixing the yellowish coloring matter of the lye. This injurious effect can be prevented by adding to the water a mixture of sodium carbonate and soluble glass. The effect is to precipitate calcium and magnesium silicates in a flocculent form which settles rapidly, does not adhere to the fabric, and becomes granular and pulverulent on boiling. Thus purified, only a very small quantity of caustic alkali is necessary, the greater part of the saponification being effected by means of the less injurious alkali carbonate. A convenient form in which to put up the soluble glass for this purpose is to add from 10 to 20 per cent of anhydrous sodium carbonate to a saturated solution of the soluble glass. The product is easily handled, and remains completely soluble in water. Further, the quantity necessary for a particular water can readily be calculated.

Electric Motors for Cotton Mills.

We learn from the Western Electrician that the Pelzer Manufacturing Company, of Pelzer, S. C., has contracted with the General Electric Company for a three-phase electric transmission plant that will be exceptionally large and interesting. At the generating station, three miles from the cotton mills owned by the company, there will be three slow-speed generators of 750 kilowatts each directly coupled to water wheels. These dynamos will generate current at a potential of 3,300 volts, and the current will be fed directly to the transmission wires at this pressure. The transmission line will consist of eighteen No. 00 wires, this size having been selected in preference to larger wire to reduce the line induction as much as possible under the existing conditions. At one mill will be located a 400 horse power synchronous motor, receiving current directly from the wires. There will be, in addition, more than twenty induction motors in various rooms. Of these, fourteen will be 110 horse power motors, and the others will be of various sizes, from 5 to 75 horse power. In a substation will be located nine 160 kilowatt transformers for the motors and for 1,200 incandescent lights for the mills. Two electrically operated blowers of three horse power each will be used for cooling the transformers.

Orthochromatic Photography.

Dr. H. W. Vogel calls attention to an erroneous idea that prevails regarding orthochromatic plates. He says that professionals as well as amateurs are often of the opinion that the yellow screen is unnecessary in the early morning and late in the afternoon. It seems to be argued that at these hours the atmosphere acts as a "yellow ray filter." This sounds very plausible, but the principal fact is ignored. The air is a ray filter for the direct sunlight, but also a ray reflector for the blue light. The preponderance of the blue rays in the sky diminishes from morning toward noon, and then increases again. As the object of the yellow screen is to reduce the strong action of the blue rays, it follows that the screen is very essential, both in the early morning and in the evening.

Photo Recipes.

In a recent number of the American Journal of Photography we find the following:

Bromide Prints of Different Colors.—Mr. Kajima Seibei gives the following method of producing colored bromide prints: The prints are developed with eikonogen and fixed in a neutral bath without the interposition of an acid bath, and thoroughly washed. They are then treated with the following solution:

Nitrate of lead	½ ounce.
Red prussiate of potash	¾ "
Water	12 ounces.

This converts the image from black into a faint yellow. They are again thoroughly washed, and the yel low image is then toned to different colors with various solutions as follows. For blue:

Perchloride of iron	5 ounces.
Water	6 "

For another blue, called by some a "black blue," the prints are treated with a weak solution of ferrous sulphate. For green:

Neutral chromate of potassium	½ ounce.
Water	12 ounces.

The prints are washed, and are afterward treated as for the first of the two blues mentioned. For brown, or "red sepia:"

Copper chloride	5 drachms.
Water	6 ounces.

The action of this solution is very rapid. For yellow:

Mercuric chloride	90 grammes.
Iodide of potassium	150 "
Water	8 ounces.

The action of this solution is very slow, but the prints darken in drying. By continuing the action for a long time a very pleasing color, that might be described as "light brown," is obtained.

To Change the Color of Blue Prints.—Ferro-prussiate blue prints can be easily transformed to brown by the following process: The blue print, well washed and dried, is plunged in dilute ammonia for two to four minutes, until it is almost colorless; then rinse and immerse it in a bath of tannic acid, where it is left until it is clear and toned. This operation requires about twelve hours. If, at the end of this time, the color is not sufficiently deep, add to the bath several drops of ammonia, and let the print remain in it a minute or two longer, then rinse it in plenty of water. The prints thus obtained are very pretty, and resemble in color sepia drawings. Here are the formulæ for the different baths employed:

SENSITIZING SOLUTION.

Tartrate of iron and potash	15 grammes.
Red prussiate of potash	12 "
Rain water	250 "

SOLUTION TO FADE THE PRINT.

Ammonia	100 grammes.
Rain water	900 "

SOLUTION TO GIVE THE BROWN TINT.

Tannic acid	10 grammes.
Rain water	500 "

To Change Blue Prints to Black they should be placed in water acidulated by nitric acid, then passed into a bath of water 100 parts, carbonate of soda 5 parts. The image turns to an orange color. It is immersed in a bath composed of water 100 parts, gallic acid 5 parts, and finally it is washed in water acidulated by hydrochloric acid.

Black Tones.—To obtain black tones on collodiochloride papers by means of platinum is given in Das Atelier Photographen. The following is the formula:

The celloiden paper is to be printed very deeply—much deeper than for ordinary gold toning. The washing must be done carefully, and it is better to add a little ammonia or salt to the second washing water, by means of which any chloride of silver remaining in a soluble condition will be dissolved out. From the washing water the prints go direct into the following gold toning bath:

Water	1,000 c. cm.
Acetate of soda	15 grammes.
Chloride of gold	1 gramme.

This bath can be made to keep by Kuehn's method, adding a few drops of hydrochloric acid after use, and neutralizing with soda before using again. The prints go through the ordinary tones in this bath, and the toning is stopped when they have arrived at the usual bluish tone by transmitted light. They are then slightly washed and placed in the following platinum bath:

Chloro-platinite of potassium	1 gramme.
Water	300 c. cm.
Tartaric acid	15 grammes.
Citric acid	5 "

In this bath the prints quickly become a deep velvety blue black, which if left too long becomes a bluish gray. As soon as they show a pure blue black by transmitted light, free from any tinge of violet, the toning must be stopped to preserve the half tones. It is good plan at first to treat thin slips of celloidin paper in exactly the same way as the prints, and to take these out of the toning bath from time to time—say every half minute—and test them by dropping nitric acid on them from a glass rod. When no change is brought about by the acid, the platinum toning is complete. The prints are then slightly washed, fixed in hypo (1 to 10), and dried on blotting paper. The deep blue black tone changes to pure black in the fixing bath, and the prints have brilliant whites and great depths in the shadows.

Black Stain for Wood.—The intense black color that cabinetmakers produce is obtained by moistening the wood with dilute sulphuric acid, and afterward gently heating. The following mixture answers well:

Sulphuric acid	1 ounce.
Water	8 ounces.

When cold, add sugar in the proportion of 1 ounce to 10 fluid ounces.

A New Developer.—The following was communicated to the French Photographic Society:

Water	1,000 c. cm.
Sulphite	100 grammes.

Dissolve in warm water and add—

Metol	5 grammes.
Hydroquinone	7 "

After solution—

Carbonate of potash	40 grammes.

This developer, which is very active and energetic, has the advantage of keeping without change in a stoppered bottle. For use it is well to dilute it with one-half water; the old bath may be used indefinitely by strengthening it with a little of the new bath. We may add that we have found it useful in using time plates to add a few drops of bromide.

Reducer for Dense Negatives.—

Water	3½ ounces.
Ferrous oxalate	80 grammes.
Sulphite of soda	65 "
Oxalic acid	20 "
Hypo	6½ drachms.

An Intensifier for Negatives Reproducing Lines.—

Water	1,000 parts.
Iodine	14 "
Iodide of potassium	27 "

The negative is allowed to remain in this until entirely yellow. It is thoroughly washed, so that the water running from it is colorless. Afterward the negative is placed in a 1 per cent solution of Schlippe's salt rendered alkaline by a little caustic soda.—Paris Photo.

Liquid Chlorine.

The actual manufacture of liquid chlorine is being carried on by a firm of alkali makers in Salinders. Until now the only form in which this valuable bleaching agent has been put upon the market has been chloride of lime or chloride of soda, and either of these forms cannot contain more than 38 per cent of available chlorine. The process of manufacturing the liquid is, on the whole, quite simple. The condensing pump is constructed in the form of a U, and is made of cast iron with a lining of lead. The limb of this tube, which holds the chlorine, is partly filled with strong sulphuric acid. The other limb is filled with petroleum and is provided with an ordinary piston. The up-stroke of this piston causes the petroleum to rise and the sulphuric acid to fall. The chlorine is then allowed to rush into the vacuum thus formed from a side tube. A leaden valve arranged at this opening prevents the chlorine from re-entering the side tube. The down-stroke of the metal piston compresses the chlorine through another pipe into the refrigerated receiver, which is also provided with a leaden valve to prevent the return of the chlorine. The chlorine gas is thus moved by a piston composed of sulphuric acid, this being considered capable of withstanding the action of the gas. The receivers in which the chlorine is transported hold about 100 pounds of the liquid. They are built of wrought iron or steel to withstand the pressure exerted on them by the chlorine and weigh about 225 pounds each.

Enterprise of the Brush Company.

About 1 o'clock in the morning of October 13 last a telegram was sent from J. E. Ridall, Pittsburg agent of the Brush Electric Company, to his company's works at Cleveland, to the effect that the station of the Allegheny County Light Company, of Pittsburg, had been partially consumed by fire and twelve 65 light arc dynamos in the plant damaged to an extent which rendered them useless.

This telegram, through some delay, did not reach Superintendent C. W. Phipps, of the Brush Company, at his residence until as late as 2 A.M. Dressing immediately, he hurried to the house of Manager A. D. Dorman of the order department, and after a hurried consultation Mr. Phipps and Mr. Dorman quickly agreed upon a plan of action. Before 11 A.M. the twelve 65 lighters were ready for shipment, a number of the dynamos having to be partially assembled. At 3:35 P.M. they were in Pittsburg, the run having been made in 4 hours and 35 minutes, better than average passenger time.

The total time consumed from the receipt of the telegram by the Brush Company until the machines were delivered at the station was 14 hours.

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Boiler shops, etc. Minneapolis, cruiser. Cramp dry dock. Massachusetts, battle ship. Offices. Collier Lebanon. Private yacht. Gun foundry. Iowa, battle ship. St. Louis, American line. Armored cruiser Brooklyn. St. Paul, American line. Tank steamer Manhattan. Indiana, battle ship.

BIRD'S EYE VIEW OF A REPRESENTATIVE AMERICAN SHIP YARD—WM. CRAMP & SONS, PHILADELPHIA, PA.

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THE CRAMP SHIP YARDS.

(Continued from first page.)

"spaced" along the keel, they are held in position by a very complicated system of false work or scaffolding. To facilitate this work, a great number of railroad tracks have been arranged, so that the heavy pieces may be readily carried to any part of the yard. The Cramps own three small steam engines, and these are used especially for this purpose. In connection with this work an ingenious combination of the locomotive and the derrick is frequently used. The machine is operated by one man, and runs backward on the tracks, lowers and hoists, and turns laterally upon its tracks. The yard is also supplied with many forms of derricks, which are set up in convenient positions to be used in placing the heavy parts in position. A number of small forges may also be moved about to various parts of the ship to heat the bolts for riveting.

The lighter parts of this material are forged in the yard. The iron foundry for carrying out this work is the most extensive one in America, being 415 feet long by 264 feet wide. This is well equipped with much valuable machinery. The heavier parts of vessels, such as the steel armor plates, are made by special contract outside of the yard. The material used in constructing the vessels is stored in a special section reserved for it, comprising 10½ acres of space. This is provided with stationary and traveling locomotives and derricks for handling the heavy pieces. A special feature is an immense traveling crane moving over an area 350 feet long and 50 feet wide, and operated by a steam engine.

After the plates have been united to the steel frame of the hull, the work of putting in the boilers and other machinery is carried out. The boiler shop, which now comes in use, is the largest shop of its kind in America, and one of the largest and best equipped in the world. It is 387 feet long and 112 feet in width. An interesting feature of this shop are the two huge traveling cranes. These are run by electricity and move swiftly from one end to the other of the immense shop, often lifting and carrying boilers weighing 70 or 90 tons. The power house, which supplies the energy to operate these acres of machinery, is also one of the best equipped plants of its kind. It includes extensive hydraulic, pneumatic and electric plants, whose power is distributed through the ship yard by means of pipes or wires, as the case may be, and applied to the operation of portable drills, riveters, lighting, ventilation, blowing furnace fires, bending and shaping machines, moving derricks and various other uses.

The manufacture of various materials used in the ship yard includes an extensive brass foundry, fully equipped to produce every variety of brass, bronze, manganese bronze and white metal castings. There are extensive facilities for making castings and the complement of cranes and traveling machinery. Adjoining the brass foundry is an ordnance plant fully equipped for the manufacturing of breech-loading rapid-fire cannon up to and including 4 inch caliber, and for making projectiles of every variety required for them.

In connection with the yard is a large dry dock, 462 feet long by 70 feet wide, with a draught of 22 feet on the sill at mean high water. This is shown at the upper left-hand corner. The water front of this dry dock is 234 feet. Connected with this is a marine railway capable of hauling out vessels of 1,000 tons register. In addition to these facilities the Cramp Company is permitted to use the United States dry dock, at the League Island Navy Yard, for docking and repairing vessels too large for their own docks

To perform the work of handling heavy materials such as boilers, cannon, etc., a monster floating derrick has been constructed which is capable of lifting a weight of 125 tons. The Atlas as it is called is said to be the most powerful derrick in the world. It rests on a floating base and rises to a height of 110 feet. It affords a perpendicular lift of 60 feet, the overhang of boom being 35 feet. The first page illustration will give a good idea of the manner in which the derrick is used. The steamer lying beside the derrick is the well known man-of-war New York. The photograph was taken while the Atlas was in the act of lowering one of the 70 ton boilers to the hold. The work of raising the boiler, carrying it a distance of 80 feet and lowering it into position was accomplished in the remarkably short time of twenty-six minutes.

EQUATORIAL STAND FOR SMALL TELESCOPES.

BY GEO. M. HOPKINS.

One hour's use of an equatorially mounted telescope will convince the amateur telescopist who has been used to the altazimuth stand that the advantages possessed by the equatorial are very great. The ease with which an object may be followed, and the facility with which a star can be found, when the mounting is provided with graduated circles, which may even be crude, warrant the outlay if the stand be purchased, or the labor and expense, if the amateur should choose to make the stand with his own hands.

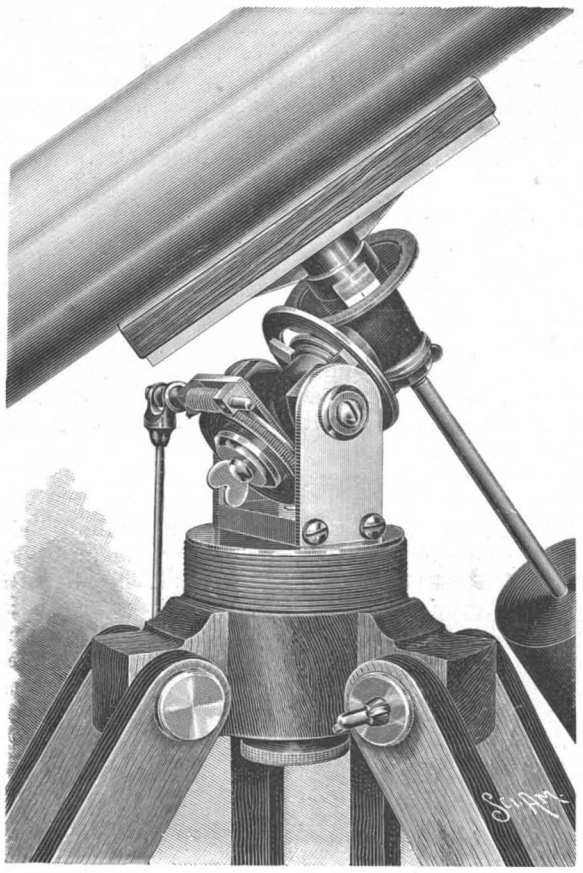

Fig. 1.—EQUATORIAL STAND FOR A SMALL TELESCOPE.

The writer, adopting the latter plan, constructed a very satisfactory equatorial stand using stopcocks for the two axes, as shown in perspective in Fig. 1 and in detail in Figs. 2 and 3, and although the construction may be readily understood by reference to the illustrations, a few words of explanation may be of service.

The telescope for which the stand was made has a three inch objective with focal length of 40 inches. The tube, which is of brass, is re-enforced by an internal plate, held in place by screws, and this plate receives the screws by which the attachment to the stand is made.

On the top of the wooden part of the stand rests a brass disk, which, together with the brass block, A, forms the base of the telescope support. To the ends of the block, A, are secured upright end plates, B, which are perforated near their upper ends.

Between the plates, B, is placed a three-fourths gas service cock, C, the ends of which are plugged, and the square ends of the plugs are turned, forming trunnions, which enter the perforations of the plates, B, but do not pass quite through. The trunnions are tapped to receive screws, on which are placed washers, which bear against the plates, B, and clamp them against the ends of the stopcock, which is faced off so that it is of exactly the same length as the block, A. The trunnions form the axis on which the telescope is tilted to adjust it for latitude, and one of the angles of the hexagon end of the stopcock is filed off even with the rounded upper end of the adjoining plate, B, and a line is drawn across the plate and stopcock when the polar axis of the telescope is parallel with the earth's axis, so that readjustment may be made without trouble.

The plug, D, of the stopcock, C, has a projecting end, having one flat side, to which is fitted the usual washer, a. This washer is turned down to receive the disk, b, which is soldered to the washer. The disk, b, is faced with wash leather. The end of the plug, D, which is threaded to receive the nut, when the stopcock is applied to its intended use, is covered with a piece of tubing soldered to the screw, and turned off to receive the worm wheel, E, which turns freely thereon.

To the end of the plug, D, is fitted a cap, F, which is held in place, and made to exert more or less pressure on the worm wheel, E, by the thumbscrew, c, which enters the end of the plug and bears on the cap. The cap, F, is perforated to receive two studs projecting from the end of the plug.

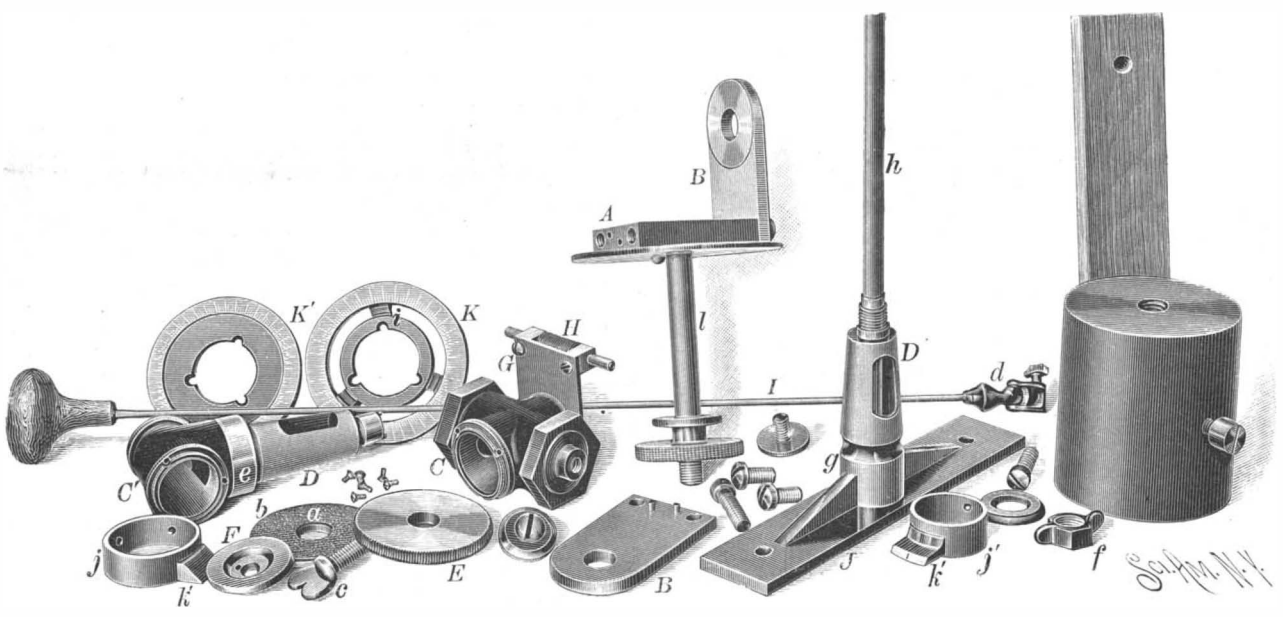

Fig. 2.—PARTS OF SIMPLE EQUATORIAL STAND.

On the smaller end of the stopcock casing is soldered a perforated plate, G, which supports the bearings for the worm, H. This worm engages the worm wheel, E, and its axis is prolonged beyond the bearings, to receive the universal joint, d, of the rod, I, this rod being of sufficient length to be easily grasped by the observer. The squared end of the plug, D, which is intended for receiving the key by which the plug is turned, is in this case turned and threaded to fit the bushing, e, inserted in one end of the stopcock, C'. The other end of this stopcock is cut off, and the opening thus left is closed by means of solder. The plug, D', of this stopcock is unchanged so far as the threaded smaller end and washer and nut are concerned, but the nut, f, is slotted in diametrically opposite corners to receive wings which are soldered therein. The square end of the plug, D', is turned and threaded to receive the boss, g, of the cross arm, J, attached to the telescope. The cross arm shown is built up of pieces of brass fastened together with screws and soldered. A casting would doubtless be simpler. The plug, D', is drilled axially to receive the counterbalance rod, h, which is screwed into the plug, as indicated in the sectional view.

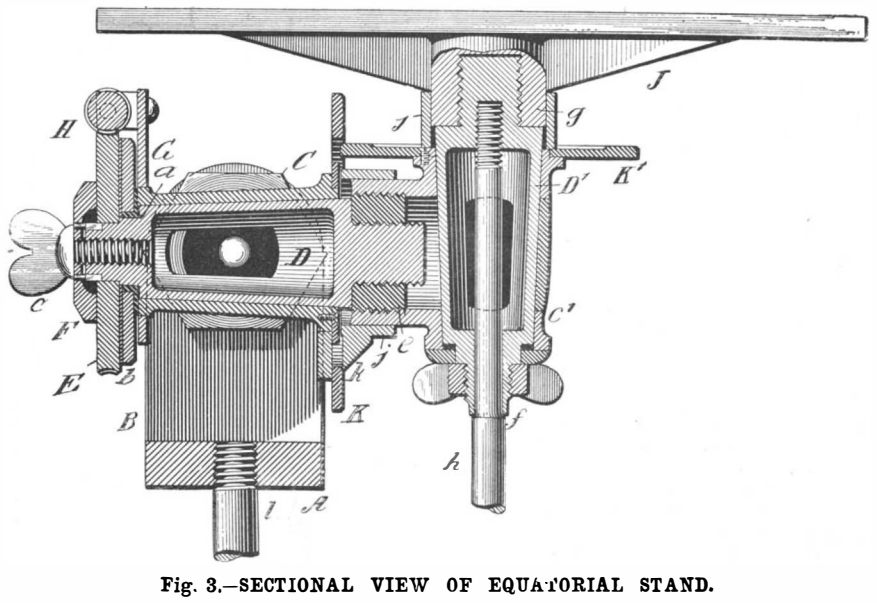

Fig. 3.—SECTIONAL VIEW OF EQUATORIAL STAND.

The larger ends of the stopcock casings are rebated to receive the graduated circles, K, K', secured in place by small screws.

Owing to the close connection of the parts, the circle, K, has an annular slot which cuts it into two concentric pieces, held in proper relation to each other by arms, i, soldered to the back of the circle.

This arrangement allows the circle, K', to swing freely.

The hexagon end of the stopcock, C', which receives the bushing, e, is turned to receive the ring, j, carrying

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a beveled index piece, k, about ½ inch wide. A line drawn down the face of the piece, k, serves as an index. In a similar way a ring, j', fitted to the boss, g, serves to carry an index for the circle, K'.

The circles here shown are electrotypes made from a galvanometer scale, soldered to brass plates and silvered, some black varnish being rubbed into the graduations to render them more distinct.

The equatorial mounting is secured to the head of the wooden stand by the rod, v, screwed into the block, A, and provided with a milled nut on its lower end.

In Fig. 1, the mounting is shown adjusted for the latitude of New York, 40° 41'. The screw, c, and nut, f, being loosened, and the polar axis being parallel with the earth's axis, the telescope is pointed to a star or other object, when the nut, f, is tightened, thus clamping the declination axis. The screw, c, is also tightened, when the instrument will be made to follow the object by turning the screw, H.

Although the slow movement is of great utility, it may be omitted and the instrument may be guided by the hand. The mounting may be further simplified by omitting the graduated circles, and still possess great advantages over the altazimuth mounting.

A stand formed of three-quarters service cocks is large enough for a three inch telescope. It has a smooth and steady motion and does not vibrate. There is, however, no objection to the use of larger stop-cocks.

The hints here given may serve as suggestions. The amateur may carry out the work in different ways. The reader is referred to Gibson's "Amateur Telescopist's Handbook" for simple instructions for using and adjusting the equatorially mounted telescope.

Four Year Old Ice.

It is stated by Portland ice dealers that this has been the best year for business on the Kennebec since the great season of 1890. One man says that some ice four years old has been sold. "This is very unusual," says the Portland Press. "Ice that is four years old costs more to get out of the houses than it costs to cut it in the first place. For it is the ice that is at the bottom of the house, and has been consolidated into a solid mass by the water flowing down from the melting cakes above and freezing these underlying cakes together. To run out a block from this is very difficult, for it is like quarrying stone from the solid ledge. It is a good thing that it can be sold, if only for the cost of handling it, because it must be got out of the building somehow. Generally they bore holes in it with an auger, put in a stick of dynamite, and blow the ice into fragments, which are then shoveled out."

Report of an Engineering Insurance Company.

A prominent engineering insurance company in England has recently made public some very interesting figures concerning the causes of accident to engines and boilers. During the past year the company found that 33 per cent of the accidents to the boilers insured in their company were owing to weakness, faulty construction, and bad workmanship; 27 per cent were due to purely accidental causes; and only 12 per cent were the result of carelessness of owners or attendants. The great majority of the accidents were owing to the failure of spur gearing and to defects in valves and valve gear. A large number, however, were due to defective columns, bed plates, and pedestals, and to the failure of screws, bolts, cotters, and straps. The company made in all some 40,000 boiler inspections, and these led to the discovery of 575 cases of defective grooving, 146 fractures and blisters, 150 safety valves dangerously overloaded, and 175 water gauges out of order. The report finally states that out of nearly 1,000 boilers found to require immediate attention, a great many would have been run without repair until they had exploded.

Protection of Iron Columns.

Some experiments were recently made by the Building Inspection Department, Vienna, says Engineering, on the protection of iron from fire by incasing it with brick. A wrought iron column 12 feet long, and built up of two channels connected by lattice bars, was used. This was set up in a small chamber constructed of brick, and the column was loaded by levers. This done, it was surrounded by a 4½ inch brick wall laid in fire clay mortar. The wall did not fit closely around the column, and advantage was taken of this to fix there samples of fusible metals, and which should serve as a gauge of the temperature attained.

Various samples of stone concrete and other materials were also placed in the chamber within the column. This chamber was then filled with split firewood, which was lighted and the doors immediately walled up with slabs of plaster of Paris. After the fire had burned out, the doors were broken in and a stream of water turned into the room from a 14 horse power fire engine. An examination of the room next showed that the walls of brick laid in Portland cement retained their strength, while most of the natural stone left in the chamber had been destroyed. The ceiling had been lined partly with plaster of Paris and partly with terra cotta tiles. Both were damaged. The inclosure around the iron pillars was still standing firm, though corners of the brickwork were clipped one inch or so, and the fire clay mortar was largely washed out of the joints. On removing the casing, however, the pillar was found to be uninjured, even the paint being unscorched, and the fusible plugs only showed a temperature of 149 degrees Fah.

A Wire Fly Wheel.

Among the most recent and novel applications of wire, perhaps none has greater interest to the mechanical world than that presented by the new wire fly wheel lately erected at the Mannesmann Tube Company's Works, Germany. Heavy fly wheels driven at high velocities obviously present dangers of breaking asunder from the great centrifugal force developed. The wheel at the factory mentioned consists of a cast iron hub or boss to which two steel plate disks or checks, about 20 feet in diameter, are bolted. The peripheral space between the disks is filled in with some 70 tons of No. 5 steel wire, completely wound round the hub, and the tensile resistance thus obtained is far superior to any casting. This huge fly wheel is driven at a speed of 240 revolutions per minute or a peripheral velocity of about 2·8 miles per minute, which is nearly three times the average speed of any express train in the world. The length of wire upon such a constructed fly wheel would be about 250 miles.—American Manufacturer.

Business Aphorisms.

Carlyle wasn't a man of business, but he would have made a success of it, had he tried it. In his writings one finds these lines of solid business truth:

A laugh is worth a hundred groans in any market.

Have a smile for all, a pleasant word for everybody.

To succeed, work hard, earnestly and incessantly.

All honest men will bear watching. It is the rascals who cannot stand it.

Better have the window empty than filled with unseasonable and unattractive goods.

When you hang a sign outside your place of business, let it be original in design and of good quality.

Wondrous is the strength of cheerfulness; altogether past calculation its power of endurance. Efforts to be permanently useful must be uniformly joyous, a spirit of sunshine, graceful from very gladness, beautiful because bright.

RECENTLY PATENTED INVENTIONS.

Engineering.

FLUE CLEANER.—Joseph O. Frazier, McCall, La. This is a readily applied apparatus for quickly removing all soot and other impurities in the flues by means of jets of steam. From a valved pipe connected with the steam supply a series of branch pipes are adapted to be extended centrally through the flues of the boiler, each of the branch pipes being provided with bearings on which they rest in the flue, and having also inclined nozzles, so that when the steam is turned on it strikes the inner wall of the flue at an angle, the jets thus removing and washing outward all impurities.

Railway Appliances.

CAR COUPLING.—Alonzo C. Packer, Pittsburg, Pa. This is an improvement in couplers of the Janney type, and is adapted for automatic coupling with another of the same kind, and for safe uncoupling from either side of the car. The recessed drawhead is vertically slotted and transversely apertured, there being a pivoted latch block, and a locking key being shouldered on the front edge and working in the vertical slot. The key locks the latch block when depressed, and a lifting bar passing through a lateral slot in the key has a cam slope on its top edge engaging the upper edge of the key slot to elevate the key when the bar is moved.

CAR COUPLING.—Blan B. Haydon, New Castle, Ky. This is a simple coupling which couples automatically when the cars come together, the uncoupling being effected from either the top or side of the car. The drawhead has a transverse coupling shoulder at the front end of the bottom of the mortise, in which is held a yielding member, and a coupling jaw in the top of the mortise is pivoted at its rear end and has its front end spring-pressed toward the bottom of the mortise. The front end of the coupling jaw has a transverse flange on its under face, and the link has its ends beveled and formed with transverse coupling shoulders. The link members can be readily coupled with the ordinary link and pin couplings.

STATION INDICATOR.—Dennis B. D'Orsey Blake, Denver, Col. Attached to a street car, this device automatically indicates to the passengers the name of the street or station passed or approached. It comprises an operating shaft geared to the car axle and formed in telescopic sections, there being a cam or spiral groove in one shaft section and in the other section a pin entering this groove, and gear wheels on the shaft sections, with shafting geared to the indicator, intermediate gears being alternately and automatically engaged when the rotation of the axle is reversed. A suitable dial in the car is marked with the points to be indicated in their relative positions, and a pointer actuated by the axle connections traverses the dial as the car moves over the route in either direction.

BLOCK SIGNAL.—James V. Richardson, Farmville, Va. According to the system devised by this inventor the signaling apparatus is carried by the engines on the line, the arrangement being such that two engines cannot run upon adjacent blocks, either toward each other or in opposite directions, without operating the signals in both engines. Parallel line conductors are arranged in blocks, and the locomotives carry contact-blocks with a signal in circuit. A circuit breaker connects the blocks of line conductors, and has cross connections to connect the positive conductor of one block to the negative conductor of the next, and connections to connect the positive and negative conductors of one block to the similar conductors of the next.

BRAKE SHOE.—Henry A. Lewis, Norristown, Pa. This shoe and attachments are so made that the shoe may be readily reversed, or a new shoe be substituted for an old one, the holder being conveniently removed from the brake beam, and the shoe when in place being held with the necessary rigidity. The improvement is also adapted for use on any wheeled vehicles as well as on railway cars. On the back of the shoe is a dovetailed, notched rib, and the holder has a dovetailed groove and dovetailed socket, with a slot in which is pivoted a spring-pressed pawl whose lower end engages the notch of the rib while its upper end projects out through the slot.

TIMBER TIE.—Luman C. Ingersoll, Keokuk, Iowa. Excepting at the two places on its top where the rails are attached, the sides and ends of this tie are beveled outwardly, thus giving a larger flat surface on its bottom than on top. Square shoulders are formed where the bevels commence on each side of the rail bearings, whereby the tie is more firmly engaged by the ballast, affording a high degree of safety against lateral displacement of the track.

ELEVATED RAILWAY.—John N. Valley, Jersey City, N. J. The structure for an elevated road designed by this inventor comprises but few elements, and may be built at comparatively low cost without the aid of skilled workmen. Suitable posts support transverse girders to which are secured hangers of inverted U-shape, to the depending arms of which are secured angle irons carrying channel iron tracks. The tracks are adapted for reversal to bring the flanges either inside or outside the structure, and the rails are secured to the channel irons.

ELEVATED ROAD CARRIAGE.—The same inventor has devised wheeled hangers especially adapted to suspend a car, or logs or other loads, the carriage being of simple and inexpensive construction, with proper strengthening members, a novel propelling mechanism and suspension devices. The improvement affords safety against derailment, and the driving mechanism is capable of producing high speed, the car being cushioned in a simple and efficient manner.

CONDUIT RAILWAY TROLLEY.—Walter E. Delabarre, Francis M. Frazer, and Robert A. Carrick, New York City. The construction of this conduit is such that the main electrical conductor is protected from the action of the weather, and the opening through which connection is made with the car is so located that it will serve as a channel for the flange of the wheels. The trolley is connected to a transmitting arm projecting through the slot, there being secured to the arm a covering of insulated material having at its ends bevels facing in the opposite direction from that of the trolley.

Mechanical.

REAMER.—Foist Hatmaker, Ithaca, N. Y. For the use more especially of plumbers, in the repair of faucets, bibs and similar articles, this inventor has designed a reamer having a hollow handle and adapted to carry a reversible shank formed at one end with a fixed cutter head, while supporting at its other end a reamer with adjustable cutters.

SIDE DRESSING SAW TEETH.—George Fritz, Rib Lake, Wis. This inventor provides a device for use on band or gang saws after they are swaged, to quickly dress both sides of the teeth. It comprises two arms having jaws engaging the sides of a tooth, one of the arms supporting a tooth guide to engage the front and back of a tooth; a guide bolt passes through the arms, and on it one of the arms moves toward and from the other, while a cam lever fulcrumed on the bolt engages the movable arm.

Agricultural.

THRASHING MACHINE.—Isaac W. Woodburn, Rock Rapids, Ia. In this thrasher the power and the machine are mounted on the same wheels, and the engine may also be utilized to move the machine from place to place. The construction is simple, strong, and inexpensive, and the machine is operated without end or side shake, the various rotating cylinders for cleaning purposes, together with the conveyers and air supply, effectually cleaning the grain after it is separated. The machine does not need leveling and setting, and the blower does double duty, drawing the chaff from the grain and expediting the exit of the straw from the machine.

FODDER OR FEED LOADER AND SLED.—Edwin F. Lewis, Vine Creek, Kansas. This is a low-wheeled sled for gathering and carrying hay, and is to be used in connection with a slatted gathering platform or loader upon a single axle, the loader being entered beneath the shock to gather a certain amount of hay and then being carried a portion of its length over the sled, to which the hay is thus readily transferred.

Miscellaneous.

PNEUMATIC BICYCLE TIRE.—Cevedra B. Sheldon, Brooklyn, N. Y. This is a tubular tire whose inner portion may be stretched at one or more points more than its outer periphery, whereby the tire may be readily slipped on or off without collapsing and without the use of special tools. This tire is also armored in an improved manner, to render the tire proof against puncture or penetration, the armor possessing such a degree of flexibility and resilience as not to interfere with these qualities in the tire as a whole.

MOTIVE POWER FOR BICYCLES, ETC.—Julius Tullius, New York City. In the driving mechanism devised by this inventor a sliding pedal shaft projects through a bearing sleeve having cupped ends in which socket plates are fitted and secured to the shaft, there being balls in the bearings formed by the cupped ends and socket plates, and gear wheels of different sizes loosely mounted on the pedal shaft and loosely connected with the ends of the sleeve. By pressing with the foot on either the right or left crank arm with the foot the operator may carry the shaft to the right or left, to change the mechanism for speed or for power, according to the road being traveled.

SEXTANT ATTACHMENT.—Thomas T. H. Ferguson, Hankow, China. By means of this improvement the ordinary sextant may be converted into an instrument for measuring large angles, say from 120 to 240 degrees, as well as angles from zero to twenty degrees. The invention consists principally of a full silvered glass or mirror and a half silvered glass, the latter being substituted for a horizon glass in the plate of the instrument and the mirror being attached to a vernier indicating on a graduated arc.

ELLIPSOGRAPH.—John A. Caldwell, Vancouver, Canada. This is a device to facilitate the drawing of almost any kind of an ellipse. A sleeve is fitted to slide loosely on one of the legs of a compass, a rod adjustable in the sleeve standing at right angles to the leg carrying the sleeve. A holder is held on the rod and in it is adjustably held a second rod in which is pivoted a pen support, a pin being held adjustable on the pivoted support.

MANIFOLDING DEVICE.—Edwin B. Tilton, Brooklyn, N. Y. This improvement consists of a board, cut away for a hand space at opposite sides, and with right angled flanges on adjacent edges, together with projecting pins near one end, affording a cheap and simple contrivance for the use of typewriters, to facilitate the quick and accurate assembling of sheets of paper and carbon sheets.

INK WELL.—William B. Pratt, Rahway, N. J. This inventor has devised a cover attachment which may be applied to an ink well of any description, in such manner that it may be sealed air tight when not in use. The cover is held closed under tension, but the opening and closing may be effected with one hand.

PNEUMATIC GRAIN CONVEYING.—Frederic E. Duckham, Millwall Docks, London, England. This invention relates to former patented inventions of the same inventor, and particularly to the suction inlet nozzle of apparatus for loading, unloading and transferring grain and other granular matters in bulk by an exhaust current of air. The height above the inlet of the nozzle at which the air sleeve should terminate being dependent upon various circumstances, it is necessary to vary the relative positions of the nozzle and its air sleeve. The invention consists in making the air sleeve adjustable with regard to the nozzle, and

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providing means of adjustment and means of regulating the air supply through the sleeve to the nozzle.

INLAYING METAL GOODS.—Henri F. L. Aumont, London, England. This inventor has devised a mode of inlaying with tortoiseshell or celluloid, watch cases, jewelry, ornaments, etc., of gold and silver and other metals without the use of cement, producing a transparent, enamel-like effect. The pieces of material to be inlaid, when softened by heat, are squeezed into interlocking engagement with the grooved or beveled edges of through apertures in the metal, the pressure being maintained until the work is cold, when any superficial excess of the inlaid material is removed.

MANHOLE FOR SEWERS.—George Wright, Winnipeg, Canada. To ventilate the manholes of sewers and purify their obnoxious or deleterious gases, the manhole is, according to this invention, fitted internally with a cast iron cylinder provided with a ventilating cover, near which is held a mud pan, while a deodorizing basket is removably supported at the lower end of the cylinder. This basket is charged or recharged with deodorizing material, preferably broken charcoal, or lime, tar, etc., as often as may be desired, or when disease is raging in a town a grate may be substituted for the basket and ordinary charcoal burned thereon.

UMBRELLA.—William R. Tebow, Tiskilwa, Ill. This inventor has devised a strong and durable runner and improved the construction of the crown-piece, connecting the ribs and braces with the crown-piece and runner by ball joints, to cause the parts to work easily. The crown-piece and runner are small, and without projecting portions to injure the fingers or tear the cloth, and their construction is such that any brace or rib may be easily taken out and repaired. The umbrella joint combines strength, lightness and durability with handsome appearance and capacity for a large number of braces without making the joint large or the braces weak.

POCKET KNIFE.—John P. Nordlow, Worcester, Mass. In the knife devised by this inventor the blade is so held in the handle that the blade may be quickly and easily opened and rigidly held in open position, no matter how long the blade may be. The blade may be opened from its heel or tang, and it may also be locked in upright position, or at right angles to the handle, so that it will not move backward or forward.

POCKET KNIFE.—Carl C. Moritz and Stephen D. Greenwood, Salt Lake City, Utah. This knife costs but little more than an ordinary one, but it is so constructed that it may be easily separated into its parts, and the blades, partition plates, and springs readily removed and new parts substituted. The parts are so arranged that they may be firmly put together and the knife externally presents the usual appearance.

HAIR CURLER.—Thomas C. Moore, Great Falls, Montana. This implement has a tapered tubular body at whose larger end is a radial flange on which is loosely fitted a ring or collar to which is pivoted a clamp arm. When a lock of hair is wound close to the head or face, and, on the last turn, the clamp does not come into due position to enable it to hold the lock tightly curled, it may be adjusted or revolved to enable it to do so.

HOOK AND EYE.—Joseph F. Schoeppl, Pittsburg, Pa. This invention provides a connecting device formed of a body portion with hook members extended from one side, wings projecting from the ends and an extension from the body between the wings. It is inexpensive, being stamped out of resilient sheet metal, is readily attached to the garment without stitching, does not flap or bend outward from the fabric, and when once secured in the garment cannot be pulled out in ordinary use.

HEAD REST FOR BEDSTEADS.—George G. J. Millar, Groveport, Ohio. This is an improvement upon a formerly patented invention of the same inventor, providing for invalids a head rest which is readily adjustable to any desired position without throwing the body out of a straight line, and without much exertion of the attendant. The invention consists of a covered U-shape frame having a pivoted leg or brace, fastened in place by a cord, the covering material being permanently secured to one side of the frame, and laced to the other side, whereby it may be always drawn tight.

BEER DRAWING AND SAVING APPARATUS.—William R. Dales, New York City. This apparatus comprises a vacuum tank and a beer discharge pipe connected by a two-way faucet to which a hood is applied, with means for controlling the discharge and inlet pipes. The improvement enables the froth to be sucked from the top of a glass of beer as it is drawn, the froth being delivered into a separate receptacle from which, after it settles, it may be sold by measure.

HORSESHOE.—Erasmus Richardson, Esbon, Kansas. This is a compound or double shoe, one section being a light racing shoe permanently nailed on, over which fits a recessed heavier section, temporarily nailed in place, and to be used only when training. The two sections are wholly disconnected from each other when off, and when the outer one is removed for racing the horse will have a practically new, light, sharp-edged shoe.

CASKET HANDLE.—Lyman E. Woodard, Owosso, Mich. The wall of the casket, according to this invention, has a recessed and perforated ear, in which is a washer, the ear and washer being secured in place by a screw, and forming a base for attachable handles. The improvement, in use, affords strong, rich base piece for handles, either of the drop style or rigidly projected from the coffin.

DESIGN FOR A ROPE CLAMP FRAME.—Per O. Olsson, Marshall, Minn. The edge contour of this frame presents a series of alternate convexities and concavities, the plate being essentially a plane surface, disposed on which is a ridge-like figure.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

HAND BOOK OF PRACTICAL MECHANICS. For use in the shop and draughting room, containing tables, rules, formulas and solutions of practical problems by simple and quick methods. Logarithm, sine, cosine and tangent tables, areas and circumferences; decimal equivalents of an inch, a foot, and a pound, bevel and spur gears, worm and worm gears, United States standard bolts and nuts, tapping drills, lathe thread cutting, cams, etc. By Charles H. Saunders. Hartford: Student Publishing Company. 1895. Pp. 116. Price $1.

The Pope Manufacturing Company, manufacturers of the Columbia bicycles, are now sending out their desk pad calendars for 1895, affording space for memoranda for each day of the year. This is the tenth annual issue of this style of calendar by the Pope Manufacturing Company, and their very extensive experience has afforded them a vast deal of bicycle literature, points illustrating which bristle upon every page.

The Overman Wheel Company, manufacturers of the Victor bicycles, have issued a neat desk calendar for 1895, consisting of a memorandum pad with blanks on which to jot down brief reminders of things to be remembered, etc., for every day in the year. It goes without the saying that it is embellished with numerous apothegms as to the excellences of the Victor wheel and the advantages of bicycle riding.

The Link Belt Manufacturing Company, of Chicago, send out a very ornamental calendar for 1895, in which a leaf of a small pad is given to each week, the pad being attached to the face of a card in colors. This company furnish shafting, pulleys, gearing, etc., and labor-saving machinery for handling any material in bulk or package.

SCIENTIFIC AMERICAN BUILDING EDITION.

DECEMBER, 1894.—(No. 110.)

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2. Elegant plate in colors, showing a residence at Chester Hill, Mt. Vernon, N. Y. Two perspective elevations and floor plans. An attractive design in the Colonial style. Messrs. Rossiter & Wright, architects, New York City.
3. A cottage at Mt. Vernon, N. Y., erected at a cost of $4,500. Perspective elevations and floor plans. Mr. Walter F. Stickles, architect, Mt. Vernon, N. Y. An attractive design.
4. The handsome residence of W. K. Clarkson, Esq., Brooklyn, N. Y., erected at a cost of $15,000. Two perspective elevations and floor plans. Messrs. J. C. Cady & Co., architects, New York City.
5. A residence of moderate cost at Bronxwood Park, N. Y. Perspective elevation and floor plans. Mr. A. F. Leicht, architect, New York City. A pleasing design.
6. The residence of W. D. Love, Esq., at Bronxwood Park, N. Y. Two perspective elevations and floor plans. Mr. W. H. Cable, architect, New York City. A neat design treated in the Queen Anne style.
7. A Colonial residence at Flatbush, L. I., erected at a cost of $7,500. Two perspective elevations and floor plans. Mr. John J. Petit, architect, Brooklyn, N. Y.
8. A residence at Mt. Vernon, N. Y. Two perspective elevations and floor plans. A pleasing design in the Colonial style. Mr. Chas. E. Miller, architect, New York City.
9. A picturesque and well appointed residence at Belle Haven, Conn., recently erected for E. C. Converse, Esq. Four perspective elevations and floor plans. An excellent design. Mr. Bruce Price, architect, New York City.
10. A Colonial cottage at Bayonne, N. J., recently erected for Joseph Thomas, Esq., at a cost complete $2,700. Perspective elevation and floor plan. Mr. A. C. Longyear, architect, New York City.
11. Miscellaneous contents.—Hints to readers.—The education of customers.—How to catch contracts.—The latest and best designs for houses.—Diamond cement plaster.—Preserving metals in roofs, bridges, etc.—A perfect roofing material.—Stamped metal ceilings, illustrated.—New wood stains.—Woodwork vs. flame.—Ebonizing wood.—A stove for heating water, illustrated.—Columbian Exposition award for copper and brass goods.—An improved band saw file, illustrated.—How to move large maples.—Value of coverings for steam pipes.—Watering garden plants.—Earthquake effect on brick buildings.—The trouble New York builders have.—Foothold on pavements.—Milwaukee water elevator, illustrated.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(6331) S. M. B. asks: What is the proper size of steam ports and exhaust ports and bridges between ports of cylinder 2½ inches by 3 inches stroke, ¾ inch travel of valve, also the power of engine at 300 revolutions per minute with 70 pounds steam pressure? Would an oscillating engine develop the same power, of same dimensions? What size boat would above engine run? Give height of frame and length of pitman rod for upright engine of above dimension, proper size of link and length of eccentric rods and size of belt and flywheel; also would small boiler, 22 inches high, 12 inches diameter, fire box 10 inches high, 10 inches diameter, flues 12 inches long, 2 inches diameter, upright, generate enough steam to run above engine? If not, what size should I have? A. Steam ports and bridges may be ¾ inch wide, exhaust port ¾ inch, all 1 inch long. The engine should develop an indicated ¾ horse power at ⅜ inch cut-off. An oscillating engine of the same size should develop the same power, but its structural defect does not recommend it. The power is suitable for a 14 foot sharp built boat of the row boat type. Connecting rod should be 8 inches long, center to center. Other details can only be made from a detail drawing. A 1¼ inch belt and 16 inch flywheel. The vertical boiler should be 26 inches high, 15 inches diameter, with twenty 1¼ inch tubes for the above engine and speed.

(6332) B. F. E. asks: What are the metals and fluids used in the chloride of silver battery? A. The central negative electrode is silver; the depolarizer which surrounds it is silver chloride; the positive electrode is zinc; the excitant is a solution of ammonium chloride or salammoniac. You can refill them yourself, if you wish to. Sometimes caustic potash is used as the exciting substance.

(6333) Denver House asks: Given a perfect wheel made to revolve free on a perfect axle, will it return from its forward motion upon stopping? A. On a horizontal axis the wheel will have a tendency to slightly turn back from the instant of stopping, to come to an equilibrium. The small difference in the size of the journal and its bearing allows the arnal to roll up the curve of the bearing box, when on coming to rest it returns to a center bearing by gravity, which gives the wheel a backward motion. This should not take place in a vertical axle.

(6334) V. B. C. asks: 1. Is there any reason why steam or water could not be used internally in a gasoline engine to cool the cylinder? A. No reasons beyond those based on practical points can be given. It seems neater and simpler to cool externally. 2. A pint of gasoline will make how much volume of vapor at atmospheric pressure? A. Two and one-half to three cubic feet, depending on the composition of the gasoline.

TO INVENTORS.

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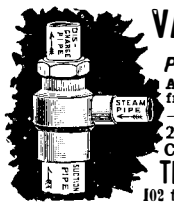

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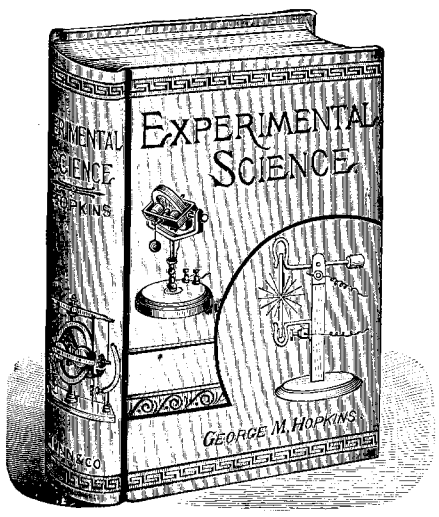

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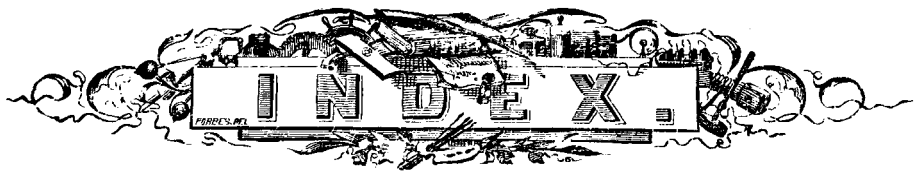

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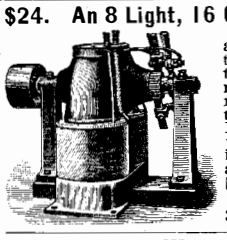

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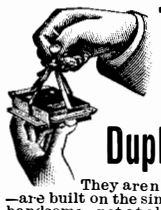

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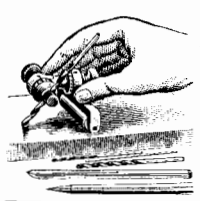

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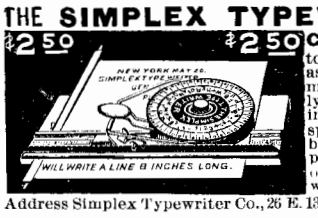

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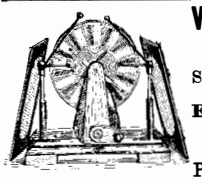

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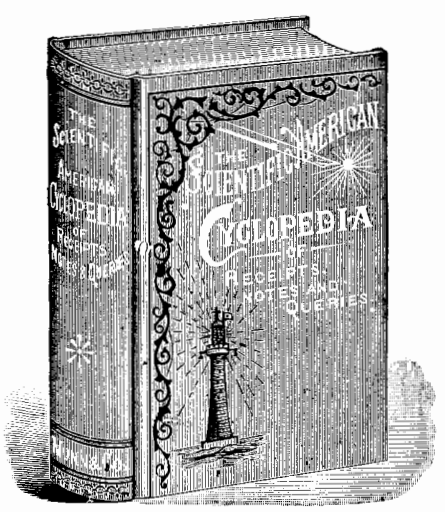

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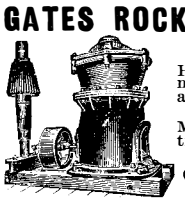

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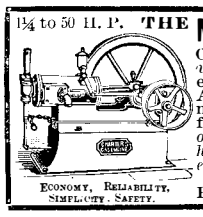

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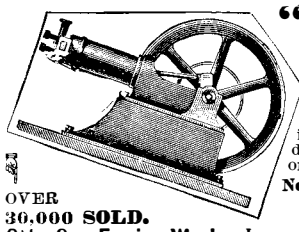

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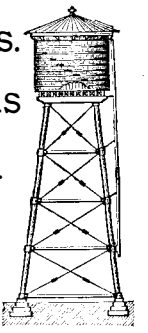

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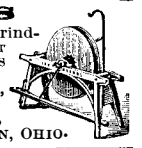

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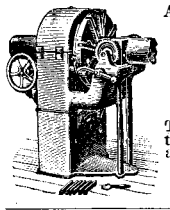

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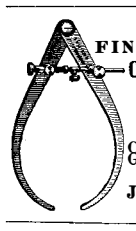

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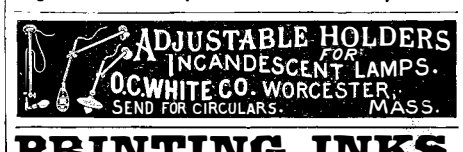

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